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Approximately 2,700 books, pamphlets, and articles from all over the world published before October 1967, are listed in this annotated bibliography on public expenditure decision making. Emphasis is on the economic criteria of decision making derived through use of systematic and analytical methods. Entries are organized into 33 general categories, including education, government, military, foreign aid, national education plans, resources, welfare, industry, systems analysis, planning, health, urban renewal, and transportation. Among the analytical techniques covered are cost-benefit analysis, cost-effectiveness, planning-programming-budgeting systems (PPBS), and operations research. An author index in one alphabetic listing follows the bibliography. (TT)

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RESEARCH FOR BETTER SCHOOLS, INC.
Philadelphia, Pennsylvania 19103

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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November 1968

Organization and Use of This Publication

This first edition contains approximately 2700 entries incorporating material from all over the world. An effort has been made to be as comprehensive as possible. The closing date for collecting new references was October 1967.

The arrangement of this work is classified into eight general categories. The categories are E, Education; G, Government; M, Military; R, Resources; W, Welfare; T, Transportation; I, Industry; and A, Other Useful Items. Each category was subdivided and given a number, e.g., Education–Forecasting Needs is number E3100.0000 and Education–Benefits for Individual Income is E5430.0000. Within each subdivision, the references are listed alphabetically by author.

The form of entry follows as closely as possible the rules from *A Manual for Writers of Term Papers, Theses and Dissertations*, third edition, revised by Kate L. Turabian and published by the University of Chicago Press in 1967.

The procedure followed was to use the author's abstract, verbatim if available, and to include but not reannotate abstracts that had been prepared under governmental auspices. Joan Rosenstein was responsible for abstract preparation when other abstracts were not available.

An author and corporate author index in one alphabetical listing follows the bibliography. Anonymous references are included in the bibliography but not in the index. Only first authors are included in the index.

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November 18, 1968

We wish to express our gratitude to the following persons who contributed to the compilation of this material:

Joan Rosenstein, a graduate student at Temple University, who served as the compiler.

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In addition, we wish to express our thanks to the individual publishers and journals who gave us permission to reprint from their material.

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Foreword

Expenditures for formal education were approximately $49 billion in school year 1966-67. Predictions based on an intensified emphasis on educational goals and projected increases in costs indicate that more than $82 billion will be required by 1975 (in constant dollars).

These figures in part explain the emphasis on economic criteria in educational decision-making. This is seen by the presence of the economist on the educational scene; the desire to examine the returns to alternative educational investments; and the general call for new and improved applications of systematic, analytic tools to educational problems.

Initially, the economist made practical sorties into the analysis of problems in the field of water resource development and later in military systems analysis. These endeavors gave impetus to further economic applications and a few methodological improvements. A substantial general interest in public expenditure decision-making evolved by the early 1960's. This was characterized by studies labeled as benefit-cost analysis, cost-effectiveness analysis, program-planning budget systems (PPBS), etc. By 1965, systems analysis often supported by economic underpinnings and operations research techniques had invaded such diverse domains as public health, food irradiation, outdoor recreation, air transportation, and education, to name a few.

To appraise this literature is difficult. But to select an appropriate technique from the countless methodological variations to apply to a particular education problem is more difficult. This is due to several factors. Exponents of many of these methods generate enthusiasm which, in turn, generates more promises than the methods can deliver. Also, substantial difficulties need to be overcome before some of these methods can be used broadly in education. Some of these difficulties are: coping with intangibles; defining criteria suitable for measurement yet acceptable to decision-makers; measuring subjective values; taking account of future uncertainties; providing standards for professional reporting; and perhaps most fundamentally, defining terminology.

Despite the complex, intertwined problems associated with applying systematic analysis to the problems of education, the outlook for improvement in this direction is promising. The criteria against which these efforts will be judged are pragmatic—e.g., are the decisions better? Are the allocations improved?

In this context, Research for Better Schools, Inc. (RBS) is presently engaged in several activities. It is experimenting on itself as an ongoing system in terms of three interrelated mechanisms: an automated accounting

system, a project control system, and a cost-effectiveness model. The cost-effectiveness model has also been applied to part of a school system.

When RBS originally felt the need to enter the field of economic applications to education, it was decided to develop a technical information file. The maintenance of the file became too costly in the face of other priorities. An annotated bibliography does, however, provide a basis to enter the varied literature of economic analysis of problems in the public sector. It also gives RBS an opportunity to share this information with those who can appreciate the significance of the economic problems education presently faces.

It is sincerely hoped this bibliography will contribute to an increase in systematic, scientific analysis in education (particularly) by providing a reasonably complete reference to the multidisciplinary literature of applications and theory of economics, operations research and systems analysis in a wide variety of field settings.

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EDUCATION

Bibliographies

E1100.0100 Alexander-Frutschi, M.C., ed. *Human Resources and Economic Growth. An International Annotated Bibliography on the Role of Education and Training in Economic and Social Development.* Menlo Park, Calif., Stanford Research Institute, 1963.

1,150 items are listed under a detailed classificatory scheme. There is a special section on areas and countries, including Africa and Asia, pp. 283-328. Some relevant topic headings are: 'Culture and the Motivation to Develop', 'Communicating Ideas for Change', 'Literacy Education', 'Community Development', and 'Rural Education'. The bulk of the literature cited is in the English language. (M. Blaug)

E1100.0200 Blaug, Mark. *A Selected Annotated Bibliography in the Economics of Education.* N.Y., Pergammon Press, 1966.

Most of the relevant items in Blaug's bibliography can be found in the present work. The reader is urged to consult this excellent work for items on the economics of education that are not in the field of cost-benefit analysis. The author can supply updated lists of work published since the appearance of this book. (Author's address: Research Unit in the Economics of Education, University of London Institute of Education, Malet Street, London, W.C.1.).

E1100.0300 Deitch, K.M. and McLoone, E.P. *The Economics of American Education: A Bibliography. Including Selected Major References for Other Nations.* Bloomington, Ind., Phi Delta Kappa, 1966.

A useful check-list by 13 major headings and sub-headings, including a section of 'Articles Reviewing Important Portions of the Literature'. (M. Blaug)

E1100.0400 *Educational Investment in Manpower Development.* Princeton, New Jersey, Industrial Relations Section, Selected References, No. 108, 1962.

A brief annotated list of books and articles on investment in human capital. (M. Blaug)

E1100.0500 Fleig, Paul, *et al. Essai de Bibliographie Choisie.* Rome, World Union of Catholic Teachers, 5th Congress, 1963.

The theme of the conference was 'Cooperation Entre les Enseignants Catholiques et les Parents Face a la Planification de l'Enseignement', and pp. 45-62 contain entries relating to planning in general and educational planning. No annotations.

E1100.0700 International Institute for Educational Planning. *Educational Planning: A Directory of Training and Research Institutions.* Paris, 1964.

International Institute for Educational Planning. *Planification de l'Education: Repertoire d'Institutions de Recherche et de Formation.* Paris, 1964.

E1100.0750 The International Institute for Educational Planning. *Educational Planning: A Bibliography.* Paris, 1964.

The International Institute for Educational Planning. *Bibliographie de la Planification de l'Education.* Paris, 1964.

E1100.0800 Munse, A.R. and Booher, E.D. *Selected References on School Finance.* U.S. Department of Health, Education, and Welfare, Office of Education, Circular No. 462. Washington, D.C., Government Printing Office, 1956.

Unannotated listing under the following headings: education and the economy; Federal Government and education; higher education; school buildings; school business administration; school personnel compensation; state aid to education; taxation for schools; transportation of pupils; unit costs in education; and other school finance references. (M. Blaug)

E1100.1000 Organization for Economic Cooperation and Development. *The Educational Factor for Development: Special Annotated Bibliography.* Paris, OECD, 1966.

A very uneven bibliography in both French and English, confined to documents published between 1961 and 1966 and available at the OECD Library in Paris. (M. Blaug)

E1100.2000 United Nations Economic, Scientific and Cultural Organization. *Bibliography in Educational Planning.* Paris, UNESCO, mimeographed, 1963.

An annotated bibliography with a detailed breakdown for all phases of the planning process, particularly useful on unpublished reports for particular countries, most of which are obtainable on application to UNESCO or the relevant Ministries of Education. (M. Blaug)

E1100.2100 United Nations Educational, Scientific and Cultural Organization. *Current Official Publications Containing Statistics Relating to Education.* Paris, UNESCO, 13 October 1961.

List of official sources of educational statistics in various countries.

E1100.2150 United Nations Economic, Scientific and Cultural Organization. *Education Abstracts.* "Training of Fundamental Education," VII, 8, October 1955; "Fundamental Education," VIII, 7, September 1956; "Long Range Educational Planning," IX, 6, July 1957; "Adult Education in Community Development," IX, 8, October 1959; "Rural Education," 7-8, September-October 1959; "Primary Education in Asia," XII, 3, March 1960; "Educational Planning. A Preliminary Listing," XIV, 2, 1962; "Teaching Comparative Education,"

XV, 4, 1963. Paris: UNESCO, 1955-1963.

Various annotated bibliographies which yield relevant material. Part of a monthly series on special subjects surveying recent literature. (M. Blaug)

E1100.2200 United Nations Educational, Scientific and Cultural Organization. *Educational Planning–A Preliminary Listing.* Paris, UNESCO, 1962.

180 references, many extensively annotated, beginning with an international section and followed by national reports and articles.

Statistics

E1200.0100 Anderson, C.A. "Regional and Racial Differences in Relation Between Income and Education," *School Review.* (January 1955), 38-45.

Using American Census data, the author shows that the effect of education on earnings differs between whites and non-whites and between different regions in the U.S.A. (M. Blaug)

E1200.0200 Blitz, R.C. "The Nation's Educational Outlay," *Economics of Higher Education,* ed. W.J. Mushkin. Washington, D.C., Government Printing Office, (1962), 147-173, 390-404.

A new estimate for the U.S.A., 1955/1958, including commercial vocational schools, and formal training for the military. An appendix calculates the incomes foregone by students, arriving at an incredible figure 75% higher than Schultz's previous estimate. (M. Blaug)

E1200.0220 Bowen, W.G. and Finegan, T.A. "Educational Attainment and Labor Force Participation," *American Economic Review,* (May 1966), 567-583.

A study of the relation in the United States between years of schooling completed and the labor force participation rate for both younger and older males as well as for married women. See the comments by W. Lee Hansen, *ibid.*, pp. 594-596. (M. Blaug)

E1200.0240 Brunner, E. de S. and Wayland, S. "Occupation, Labor Force Status and Education," *Journal of Educational Sociology.* 1958, reprinted in *Education, Economy and Society,* eds. A.H. Halsey, J. Floud, and C.A. Anderson, Glencoe, Ill., Free Press, (1961), 55-67.

The patterns of occupational distribution by levels of education in the U.S.A., noting differences between races, sexes and regions. (M. Blaug)

E1200.0400 Edding, F. "Expenditure on Education. An International Survey," *International Economic Association Conference on the Economics of Education.* London, Macmillan, 1965.

An outstanding review of the difficulties of making international comparisons in educational expenditures. A wealth of data is conveniently brought together in tables and graphs. (M. Blaug)

E1200.0500 Fischlow, A. "Levels of Nineteenth-Century American Investment in Education," *Journal of Economic History,* (December 1966), 418-436.

Estimates the total resource costs of American private and public education in the last half of the nineteenth century and compares these magnitudes to contemporary European expenditures and to present-day educational efforts. An important article full of penetrating observations. (M. Blaug)

E1200.0520 Fisher, A.G.B. "Education and Relative Wage Rates," *International Labor Review,* (June 1932), 743-764.

An early effort to draw attention to the importance of education as a factor in income distribution, particularly in narrowing the margin between skilled and unskilled workers since World War I. (M. Blaug)

E1200.0540 Fogel, W. "The Effect of Low Educational Attainment on Incomes: A Comparative Study of Selected Ethnic Groups," *Journal of Human Resources,* (Fall, 1966), 22-41.

Using 1960 U.S. Census data, this study shows that a given educational attainment has less income value for certain minority groups in the United States than for the majority. Educational attainment accounts for less than half of the difference between the 1959 median income of minority groups and the majority. (M. Blaug)

E1200.0680 Hughes, R.M. and Lancelot, W.H. *Education. America's Magic.* Ames, Iowa, Iowa State College Press, 1946.

The first and most interesting part of this book (pp. 8-87) provides a weighted educational ranking of the 48 American states based on (1) enrollment figures at various levels; (2) incomes earned per child of school age; (3) share of earned incomes devoted to education; (4) educational expenditures per pupil; and (5) the average number of school years completed by adults. The second part of the book discusses a number of educational problems in America. The final chapter, by way of attempting to substantiate the dramatic title of this book, includes enrollment data for most countries in the world for the period 1931-1940. (M. Blaug)

E1200.0700 Hungate, T.L. *A New Basis for Support of Higher Education. A Study of Current Practices, Issues and Needed Change.* New York, Teachers College, Columbia University, 1957.

An outstanding study of interstate differences in financing in the U.S.A. The appendices provide useful data on interstate differences in methods and practices of financing higher education in the U.S.A. (M. Blaug)

E1200.0800 International Bureau of Education. United Nations Educational, Scientific and Cultural Organization. *International Yearbook of Education.* Geneva. (Annual publication in English and French.)

Contains data on the various aspects of the educational system in a large number of countries, including since 1961 a section on educational planning, in the form of a comparative account and also on a country basis.

E1200.1000 Lassiter, R.L., Jr. *The Association of Income and Educational Achievement.* University of Florida Monographs Social Sciences No. 30. Gainesville, Florida, University of Florida Press, 1966.

The first study to examine the relationship between income and education, as well as rates of return on investment in education, in the United States by race, sex, urban-rural residence and region for the census year 1949 and 1959. A linear regression model is employed to estimate the strength of the relationships. (M. Blaug)

E1200.1020 Layard, P.R.G. and Saigal, J.C. "Educational and Occupational Characteristics of Manpower: An International Comparison," *British Journal of Industrial Relations,* (July 1966), 222-267.

A regression analysis, based on data for over 30 countries, of the relationship between the productivity of labor and the fraction of various types of manpower in the labor force of leading sectors of the economy. The paper discusses the implications of the findings for manpower planning. (M. Blaug)

E1200.1100 Miller, H.P. "Annual and Lifetime Income in Relation to Education: 1939-1959," *American Economic Review,* (December 1960), 962-987.

Looking solely at the income side, this study demonstrates that the relative income position of college graduates has not declined since 1939, despite the rise in college enrollment, apparently because the demand has kept pace with the increased supply. (M. Blaug)

E1200.1120 Miller, H.P. "Income and Education: Does Education Pay Off?" *Economics of Higher Education,* ed. S.J. Mushkin, Washington, D.C., Government Printing Office, (1962), 129-147.

As a warning against hasty generalizations about the private benefits of education, the author discusses two difficult cases to illustrate his point: relatively constant income differentials between whites and non-whites and between veterans and non-veterans, despite differential educational attainments. (M. Blaug)

E1200.1140 Miner, J.B. *Intelligence in the United States. A Survey with Conclusions for Manpower Utilization in Education and Employment.* New York, Springer Publishing Co., 1957.

Based on a representative sample of the U.S. population, this study investigates the significance of intelligence scores in relation to education, sex, marital status, age, race, occupation, geographical area, religion, class identification and city size. Chs. 6 and 7 formulate a method for measuring the waste of intellectual resources in education and in employment. The final chapter contains recommendations for eliminating waste. A bibliography of the literature since 1940 is included. (M. Blaug)

E1200.1200 National Federation of College and University Business Officers' Associations. *The Sixty College Study – A Second Look, 1957-1958.* Published by the Federation, 1960.

A compendium of detailed data on expenditures and income from a sample of American colleges, which provides material for some general conclusions as to where educational money comes from and where it goes to.

E1200.1250 Nguyen Huu Chau. "Les Couts de l'Education. Essai de Justification d'One Analyse Economique," *Tiers-Monde. Problemes des Pays Sous-Developpes.* (avril-juin, 1965), 421-443.

An international comparison of per pupil educational costs and a discussion of the accounting problems of interpreting such data. (M. Blaug)

E1200.1300 Organization for Economic Co-operation and Development. Directorate for Scientific Affairs. *The Education and Utilization of Highly Qualified Personnel – An Analysis of Census Data.* Paris, OECD, 1966.

A valuable document that summarizes a great deal of census information relevant to the testing of Tinbergen-type and Parnes-type models. A healthy skeptical air pervades the commentary on the data. (M. Blaug)

E1200.1400 Phillips, H.M. "International Aid for Educational Development in the Form of Technical Assistance and Real Resources," *International Economic Association Conference on the Economics of Education,* London, Macmillan, (1965).

A review of the figures of international aid for education to undeveloped countries in recent years. (M. Blaug)

E1200.1600 Stockwell, E.G. and Nam, C.B. "Illustrative Tables of School Life," *Journal of the American Statistical Association.* Vol. 58, No. 304 (December 1963).

This paper illustrates the application of life table techniques to data on school enrollments as a means of estimating school life expectancy. The school life tables which are derived are double decrement tables which show the joint effects of death and school dropouts on school attendance patterns. Such tables drawn up for 1950-1952 and 1957-1959 show the improvements in school retention by age during the last decade. Modifications of this type of analysis which would incorporate the probability of other phenomena occurring and extend the applications to other population groups are suggested.

E1200.1620 Stretch, K.L. "Academic Ecology: On the Location of Institutions of Higher Education," *Minerva.* (Spring 1964), 320-335.

Considers a neglected aspect of the economics of education with particular reference to the British scene. (M. Blaug)

E1200.1700 Thomas, L.G. *The Occupational Structure and Education.* Englewood Cliffs, N.J., Prentice-Hall, 1956.

An analysis by an educationalist of the occupational structure of the American labor force with a view to improving the quality of vocational placement counselling. Includes an uneven review of the American literature up to 1954 on the determinants of occupational incomes, the measurement of occupational prestige, and the range in occupational qualifications. (M. Blaug)

E1200.1740 Trajtenberg, R. *The Change in the Educational Content of the Labour Force. A Second Stage Analysis on the Sources of Change.* Paris, Organization for Economic Cooperation and Development, 1966.

This paper pursues the method of analysis proposed in R.G. Hollister's *A Technical Evaluation of the First Stage of the Mediterranean Regional Project.* (Paris: OECD, 1966, 146 pp.), breaking down the matrix of the educational distribution of the labour force by occupation into its various components. (M. Blaug)

E1200.1780 Tunis. *Organization of National Services for Educational Statistics.* Paris, UNESCO, 24 July 1963.

A brief statement of the types of statistics collected in Tunisia and the collection procedure is followed by examples of the questionnaires used.

E1200.1800 Tunisie, Secretariat d'Etat a l'Education Nationale. *Perspective Decennale de Scolarisation, 1959-1960. 1958-1959.* n.d.

A detailed exposition in terms of increases in enrollments, teachers, school facilities, and finance, of the requirements for the achievement of a given structure of the various levels of education over a ten-year period.

E1200.2000 The International Study of University Admissions. *Access to Higher Education, II. National Studies.* Paris, UNESCO-International Association of Universities, 1965.

This volume is a striking example of the growing interest in comparative education. It includes twelve country-studies: (1) 'Brazil' by an institution known as CAPES (pp. 15-56); (2) 'Chile' by E. Orellana and E. Grassau (pp. 59-86); (3) 'France' by M. Debeauvais, and others (pp. 89-169); (4) 'India' by K.G. Saiyidain and H.C. Gupta (pp. 173-237); (5) 'Japan' by D. Hidaka (pp. 241-280); (6) 'New Zealand' by G.W. Parkyn (pp. 283-333); (7) 'Senegal' by F. Bowles (pp. 337-347); (8) 'Republic of South Africa' by R.G. MacMillan (pp. 351-394); (9) 'U.S.S.R.' by V.A. Kitaitzev (pp. 397-435); (10) 'U.A.R. by E.S.M. El Said (pp. 439-488); (11) 'U.K.' by J.A. Lauwerys (pp. 491-589); and (12) 'U.S.A.' by E.D. West (pp. 593-648). Each chapter includes a description of current admission policies in relation to secondary education and a thorough review of the socioeconomic characteristics of students enrolled in institutions of higher education around 1960. In most cases, a country bibliography is included. (M. Blaug)

E1200.2100 United Nations Educational, Scientific and Cultural Organization. *Basic Facts and Figures.* Paris, UNESCO, 1961.

International statistics relating to education, culture and mass communication.

E1200.2200 United Nations Educational, Scientific and Cultural Organization. *World Illiteracy at Mid-Century.* Paris, 1957.

A statistical study of the extent of illiteracy throughout the world, followed by evaluation of some of the factors affecting levels of illiteracy – national income, industrialization, etc. Rather old now.

E1200.2300 United Nations Economic, Scientific and Cultural Organization. *World Survey of Education.*

Vol. I *Handbook of Educational Organization and Statistics.* Paris, UNESCO, 1955.

Vol. II *Primary Education.* Paris, UNESCO, 1958.

Vol. III *Secondary Education.* Paris, UNESCO, 1961.

These volumes contain comparative data on educational systems throughout the world, and as such are a source of comparative educational statistics.

E1200.2500 U.S. Office of Education. *Digest of Educational Statistics.* Washington, D.C., Government Printing Office, 1962.

A compilation of the more significant statistical material available in the Office of Education on the American educational system: enrollment, teachers, graduates, educational attainment, finances, and the like, sometimes going back ten years or more. (M. Blaug)

E1200.2600 U.S. Department of Health, Education, and Welfare. *"The Nation's Education Outlay."* Washington, D.C., 1962.

Statistical Studies

E1210.0400 Hanoch, G. *Personal Earnings and Investments in Schooling.* A Ph.D. Dissertation submitted to the University of Chicago, 1955. Available on microfilm from University Microfilms, Ann Arbor, Michigan, 1955.

A multiple linear regression analysis of the earnings of males in the United States in 1959, with special emphasis on the relationship between earnings and the level of formal education for whites and non-whites and between the South and the North. Calculates private rates of return on investment in education after adjustment for a large number on income-determining factors; the leading omission, however, is that of native ability. His final estimates make an interesting comparison with those of Becker for 1959, based as they are on a slightly different sample. (M. Blaug)

E1210.0500 Kaser, M.C. "Education and Economic Progress: Experience in Industrialized Market Economies," in E.A.G. Robinson and J.E. Vaizey (eds.), *The Economics of Education,* Macmillan, London, (1966), 89-173.

Regressions are made of GNP per capita and its growth on eight indicators of the content of the educational process for twelve industrialized market economies, the time series being taken back as far as statistics permit (mostly, from about 1880 to 1960). For reasons that are explained, the commonly-used indicator of enrollments as a percentage of the relevant age-group was rejected in favor of enrollments as a percentage of total population. It was shown that at low income levels, the greater this proportion, the higher was the rate of growth of GNP (viz., an economic effect of literacy through primary schooling); the correlation was weak or absent at middle levels of GNP per head, indicating that short-cycle secondary education tended not to be associated with rapid economic growth; but at higher income levels, when long-cycle secondary and higher education contribute substantially to the enrollment, the relation with speed of growth was re-established. Examination of the coefficient of students in secondary and higher education to pupils in primary schools appeared to show that at middle GNP levels per head each one percent of higher education students can substitute for five percent of secondary students, but when GNP per head is higher one percent of the former substitutes in terms of income effect for seven percent of the latter. The economic effect of higher education thus increased in terms of that of secondary pupils. Other broadly-based correlations (using pupil-teacher ratios and money outlays on education) indicated diminishing costs over time per unit of educational output, while a more limited one on teacher-salaries implied that the gap between those paid in primary and secondary schools narrowed during growth from low to middle GNP but widened during growth from middle to high incomes.

E1210.0700 Morgan, J.N., David, M.H., Cohen, W.J. and Brazer, H.E. *Income and Welfare in the U.S.A.* N.Y., McGraw-Hill, 1962.

This study of family-income determination by the Survey Research Center of the Institute for Social Research at the University of Michigan is more detailed than any previously attempted. It concludes that 'one explanatory factor looms above the others in importance in determining family income: the level of formal education of the head and his wife'. Of particular interest are the chapters on 'The Dynamics of Social and Economic Change' (pp. 331-387) which seek to isolate the 'pure' effect of education, separated from the effects of native intelligence and family background. The section of 'Educational Expectations and Attitudes' (pp. 387-427) analyzes the demand for higher education as a sequential process. See also D. Creamer, 'Some Determinants of Low Family Income', *Economic Development and Cultural Change,* April 1961, pp. 413-440, for a similar study with similar conclusions for New York State. (M. Blaug)

E1210.0800 Peaslee, A.L. "Primary School Enrollments and Economic Growth," *Comparative Education Review,* (February 1967), 57-68.

A study of correlations between primary school enrollments and per capita income since 1850, concluding that the 34 richest countries today all achieved primary school enrollments of over 10 per cent before their 'take-offs' and that no country has ever achieved significant economic growth within the last hundred years without first attaining the 10 per cent level. (M. Blaug)

E1210.1000 Shapiro, S. "Some Socioeconomic Determinants of Expenditures for Education: Southern and Other States Compared," *Comparative Education Review,* (October 1962), 160-166.

A sophisticated statistical exercise designed to throw light on spending patterns between states in the U.S.A. (M. Blaug)

E1210.1500 United Nations Economic, Scientific and Cultural Organization. *Manual of Educational Statistics.* Paris, UNESCO, 1961.

Commentary on educational statistics and the problems of their international comparability, with proposals for improving the latter.

E1210.2000 Welch, F. "Measurement of the Quality of Schooling," *American Economic Review,* (May 1966), 379-392.

A multiple regression analysis of the incomes of rural farm adult males by states, amount of schooling, quality of schooling (as measured by four indicators), age, color, and farm capital. See the comments by L.R. Martin, *ibid.*, pp. 393-394, and A.M. Rivlin, *ibid.*, pp. 395-396. (M. Blaug)

History of Thought on the Economics of Education

E1300.0100 Blitz, R.C. "Some Classical Economists and Their Views on the Economics of Education," *Economia,* 72-73, 1961, 34-60. Excerpts reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

The best account we have of the economic analysis of education in Classical Political Economy. (M. Blaug)

E1300.0400 Johnson, E.A.J. "The Place of Learning, Science, Vocational Training and 'Art' in Pre-Smithian Economic Thought," *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

A new article expressly written for this anthology, based on the author's own study of the *Predecessors of Adam Smith. The Growth of British Economic Thought* (N.Y., Prentice-Hall, 1937), i.e. Hales, Mun, Petty, King, Hume, Steuart, among others. (M. Blaug)

E1300.0500 Komarov, V.E., ed. "The Significance of Education: Excerpts from the Writings of Modern Socialists and Their Predecessors," *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

A collation from the writings of Marx, Engels, St. Simon, Fourier, and Proudhon. (M. Blaug)

E1300.1000 West, E.G. "The Role of Education in Nineteenth-Century Doctrines of Political Economy," *British Journal of Educational Studies,* (May 1964), 161-173.

Contrary to what is usually believed, the author shows that most classical economists did not attribute direct economic value to education and on the whole favored private rather than public schools. See also the author's 'Adam Smith's Two Views on the Division of Labor', *Economica,* February 1964, pp. 23-32. (M. Blaug)

Administration of Education

E2000.0100 Beeby, C.E. *Planning and the Educational Administrator.* Paris, UNESCO-International Institute for Educational Planning, 1967.

A general essay on the working relationships between educational authorities and educational planners. (M. Blaug)

E2000.0200 Callahan, R.E. *Education and the Cult of Efficiency. A Study of the Social Forces That Have Shaped the Administration of the Public Schools.* Chicago, University of Chicago Press, 1962.

This provocative book studies the application of business values and practices to American education in the years 1910-1929, concluding that the 'cult of efficiency' had tragic consequences for the American educational system. Unfortunately, the meaning of the author's indictment is left somewhat vague, particularly in view of his concession that 'the tragedy was not inherent in the borrowing from business and industry but only in the application'. Suffice it to say, however, that the book details some striking examples of the abuse of economic reasoning. (M. Blaug)

E2000.0220 Clark, H.F. *Cost and Quality in Public Education.* The Economics and Politics of Public

Education, No. 5. Syracuse, N.Y., Syracuse University Press, 1963.

An outstanding popular discussion of the problem of 'efficiency' in education, stressing the almost total failure to investigate the possibilities of improving and increasing the 'output' of schools. A review of the literature on the returns to education (pp. 15-25) cites most of the lesser known interwar items. A great deal of research in the effectiveness of different types of teaching is reviewed and the results of such research are shown to be suspect owing to a failure to allow for 'experimental enthusiasm'. (M. Blaug)

E2000.0240 Crandall, James H. "A Study of Academic Achievement and Expenditures for Instruction," Unpublished dissertation, University of California, Berkeley, 1961.

E2000.0400 Elvin, Lionel. "The Structure of Education in a Developing Country," *Planning Education for Economic and Social Development,* ed. H.S. Parnes, Paris, Organization for Economic Cooperation and Development, 1963, 171-80.

A discussion of the most relevant structure of the educational system for a developing society, and hence of educational priorities.

E2000.0600 Hayden, Howard. "Administration and the Economics of Education," *International Social Science Journal.* Vol. XIV. No. 4 (1962), 700-05. Also published in French.

An endeavor to place the economist's approach to educational planning, conceived as being essentially in opposition to that of the educator in the context of administrative possibility.

E2000.0620 Hayden, Howard. *Optimum Areas for Educational Administration in Rural Communities.* Paris, UNESCO, September 1961.

Discussion of administrative functions, and consideration of systems in a number of countries, followed by proposals for a plan for administration, specifically referring to rural areas.

E2000.0640 Hawaii. Finance Committee of the House of Representatives. Department of Budget and Finance. *Report to Legislature on a Management Analysis Program for the Department of Education.* February 1963.

E2000.0700 International Institute of Educational Planning. *Workshop on Training Educational Planning Personnel.* Paris, IIEP, 1966.

A collection of papers prepared for participants in the IIEP Workshop: R.F. Lyons, 'Problem of Training Educational Personnel' (14pp.); A.C.R. Wheeler, 'Perspectives d'avenir concernant les besoins et les ressources en personnel de planification de l'enseignement et les moyens necessaires a sa formation' (43pp.); J. Bousquet, 'Training of Educational Planning Specialists in Developing Countries' (10pp.); P.R. Hanna, 'The Training of Educational Planning Personnel at Stanford, California, U.S.A.' (7pp.); J. Hartley, 'The Training of Educational Planning Personnel in the Diploma Course in Educational Administration for Overseas Students at the University of Reading (England) Institute of Education' (5pp.); N.H. Chau, 'The Organization of Training in Educational Planning at the Institute for the Study of Economic and Social Development, Paris,' (2pp.); R.R. Butts, 'Program of Training for Education and International Affairs at Columbia University, New York, U.S.A.' (6pp.); R. Delprat, 'Programme de l'enseignement de la section 'Planification de l'education et des ressources humaines' a l'Institut international de recherche et de formation en vue due developpement harmonise a Paris, France' (6pp.); C. Watson, 'Courses for the Training of Educational Personnel at the Ontario (Canada) Institute for Studies in Education' (22pp.); M. Koti Kova, 'Formation en matiere de planification de l'education a l'universite de Prague, Tchecoslovaquie' (6pp.); R.K. Kapur, 'The Planners at the Asian Institute of Educational Planning in New Delhi, India' (9pp.); and J.D. Chesswas, 'Draft Summary of the Outcome of the Seminar on Statistics and Methodology for Professors of Educational Planning (Statistics)' (7pp.). (M. Blaug)

E2000.0800 James, H.T., Thomas, J.A., and Dyck, H.J. *Wealth, Expenditure and Decision-Making for Education.* Stanford, California, Stanford University Press, 1963.

An analysis of some of the determinants of the level and pattern of educational expenditure, and of the relationship between educational inputs and output in various American states. The authors examine the effects of variations in the level of state support, and of the degree of fiscal autonomy, on local expenditure, and also the relation between expenditure and various measures of community wealth. The second part of the study is devoted to the relationship between various input variables and output, as measured by pupil-scores in achievement tests administered as part of *Project Talent.* A relationship between test scores and expected lifetime income is postulated, but not empirically tested. (M. Blaug)

E2000.0850 Johnson, D.G. "Economics and the Educational System," *School Review.* Autumn 1957, 260-269. Reprinted in *Perspectives on the Economics of Education. Readings in School Finance and Management,* ed. C.S. Benson, Boston, Houghton Mifflin, (1963), 374-381.

A popular account of what economics can contribute to the question of efficient operation of an educational system. (M. Blaug)

E2000.0900 Kershaw, Joseph A. and McKean, Roland N. "How to Make School Decisions: An Outsider's View," *School Management,* (May 1960), 68.

E2000.0920 Kershaw, Joseph A. and McKean, Roland N. *Systems Analysis and Education.* RM-2473-FF. The RAND Corporation, Santa Monica, Calif., 1959.

A study to assess the possibilities of making quantitative comparisons of education systems (that is, comparisons of specific systems with variants in which changes and innovations are incorporated). Only elementary and secondary schools are considered. The authors conclude that such comparisons will be feasible as soon as estimations of input-output relationships in education can be established.

E2000.1400 O'Toole, John F., Jr. *Systems Analysis and Decision-Making in Education.* System Development Corp., Santa Monica, California, 28 June 1965.

Presented at the annual banquet of the Council of Directors

and Supervisors, Los Angeles City School District, Rodger Young Auditorium, May 12, 1965; Emery Stoops Lecture, Annual Awards Night, Phi Delta Kappa, Alpha Epsilon Chapter, University of Southern California, May 14, 1965.

This Paper defines the terms system, "system approach," and "systems analysis," and describes a variety of systems in defense and non-defense areas. In education, the primary focus of systems analysis is on detailed description of operations, understanding the functional interactions of system components, and the flow of information for decision-making within the system. General principles involved in systems analysis are described and some outcomes of such analysis are provided. Implications of systems analysis for more effective educational decision-making are also discussed.

E2000.1500 Platt, W.J. "Education – Rich Problems and Poor Markets," *Management Science,* (July 1962), 408-418.

The purpose of this paper is to draw attention to education as a subject for management scientists and operations analysts. It concludes with a series of questions for systems analysis. (M. Blaug)

E2000.1700 Rockefeller Brothers Fund, Special Studies Project Report V. *The Pursuit of Excellence. Education and the Future of America.* New York, Doubleday & Co., 1958.

An attempt to assess the major problems which will confront U.S. education over the next fifteen years. Problems of teacher supply, methods of financing, wastes of human resources, and many other topics in the economics of education are touched upon. Authorities like P.H. Coombs, E. Ginzberg, D. Riseman and D. Wolfle participated in the drafting. (M. Blaug)

E2000.1800 Sufrin, S.C. *Administering the National Defense Education Act.* The Economics and Politics of Public Education, No. 8. Syracuse, N.Y., Syracuse University Press, 1963.

A review of the administrative problems of the National Defense Education Act of 1958, largely with respect to elementary and secondary schools. Useful for the glimpse it affords of American attitudes to central control of education. (M. Blaug)

E2000.2200 U.S. Department of Health, Education, and Welfare, Office of Education. *Progress Towards the Goals of Project Talent.* Bulletin No. 4, 1965. Washington, D.C., U.S. Government Printing Office, 1965.

A brief description of some of the preliminary results of Project Talent with particular reference to patterns of ability and career choices. (M. Blaug)

E2000.2500 Vaizey, John. *The Control of Education.* London, Faber and Faber, 1963.

The essays which comprise the first half of this book constitute a review of different aspects of the economics of education.

Models

E2100.0100 ABT Associates, Inc. *Cost Effectiveness Study of Educational Programs for Disadvantaged Children.* Cambridge, Mass., n.d. (proposal)

E2100.0120 Abt, Clark C. "Design for an Education System Cost-Effectiveness Model," Abt Associates, Inc., 14 Concord Lane, Cambridge, Massachusetts, 1966.

A cost-effectiveness model is presented for comparing alternate projects which would implement varying aspects of Title I of the Elementary and Secondary Education Act. Detailed flowcharts are provided. As of the date of publication the mathematical design was complete, though it is not included here.

E2100.0200 Burkhead, Jesse, Fox, Thomas G. and Holland, John W. *Input and Output in Large-City High Schools.* "Education in Large Cities Series," ed. Alan K. Campbell. Syracuse, N.Y., Syracuse University Press, 1967.

The authors analyze resource allocations, variables such as teacher experience, and non-school factors in the high schools of Chicago and Atlanta to discover which are the determinant factors in relation to educational results. Input-output relationships in small-community high schools are examined for comparison, and the author's concluding recommendations will be of interest to all city school administrators.

E2100.0300 Correa, H., "Basis for the Quantitative Analysis of the Educational System," to be published in *Journal of Experimental Education.*

E2100.0320 Correa, H. "More Schools or Better Schools?" *Scientia Paedagogica Experimentalis,* Vol. III, No. 2 (1966), 123-141.

A simple exposition of the linear-programming approach to educational investment decisions. (M. Blaug)

E2100.0340 Correa, H. "Optima for Size and Number of Schools," to be published in *Scientia Paedagogica Experimentalis.*

E2100.0700 Fattu, N. and Elam, S., (eds.). "Simulated Models for Education," *Phi Delta Kappan,* (1965).

E2100.1000 Mood, Alexander M. "Operations Analysis of American Education." Paper delivered at the 1966 annual meeting of the American Political Science Association, New York City, September 6-10, 1966, printed by American Political Science Association, Washington, 1966.

Discusses the goals and methods of the Office of Education program of operations analysis.

E2100.1400 Restle, F. "The Relevance of Mathematical Models for Education," *National Society for the Study of Education, 63rd Yearbook, Part I.* 1964.

E2100.1550 Stone, Richard. "Input-output and Demographic Accounting: A Tool for Educational Planning," *Minerva,* Vol. 4 (Spring 1966), 365-380.

Describes the techniques developed by the author to pro-

vide a dynamic accounting structure for building a model of an educational system.

Case Studies

E2200.0100 Arthur D. Little, Inc. *California State Board of Education: Organization.* New York, n.d.

This year-long comprehensive study was designed for the purpose of reformulating California's State-level system of educational administration. It incorporated findings of our earlier (Phase I) study which determined changing requirements for educational leadership and service at the state level as viewed at the local district and intermediate unit levels throughout the state.

A new organizational unit is being recommended for the State Department of Education. It is an 'organic' system in the sense that the elements of the organization are both highly interdependent and related specifically to the essential functions and tasks that must be performed in order to carry out the missions of the organization. Recommended changes in organizational function and structure are based on a set of newly defined major functional requirements of the Department and its component units. These new functional requirements stress the general need for increased organizational capacity to:

Maintain a comprehensive long-range planning process;

Manage an increasingly large and complex information system;

Stimulate and support the educational innovation adoption process; and

Translate new developments in management methods and technology into Departmental applications regarding the management of human resources, time, budgets, and information.

The recommended new organizational system is analogous in many ways to those in industry where the business is characterized by: (a) a high rate of change in the state of the art, (b) the need for a number of major programs where each program is made up of representatives of a variety of skills drawn from several divisions, (c) significant variation in the possible lifetime of programs, and (d) critical requirements for flexibility and efficiency in mobilizing new program efforts and modifying existing ones to meet new challenges and significant opportunities.

E2200.0120 Arthur D. Little, Inc. *Case Institute of Technology: Linking Industry and the University.* New York, n.d.

Case Institute of Technology, in partnership with Western Reserve University and several other institutions in Cleveland's University Circle, asked ADL to determine the feasibility of establishing a research park on land abutting the Institute in order to establish a closer relationship between industry and the faculty and laboratory resources of the institutions of higher learning. In carrying out this related study, it was necessary to pinpoint the links between fundamental and applied research and also to determine the desire of industry for physical proximity to centers of higher education. (Author)

E2200.0140 Arthur D. Little, Inc. *Concord-Carlisle School System, Massachusetts: Organization.* New York, n.d.

We were engaged by the Concord-Carlisle School District to study the organization, operations, and administration of the school system. We identified and analyzed specific problems which inhibit educational planning, development, and administration. We then defined the functional requirements of the administrative system. From these basic definitions we developed recommendations regarding organizational relationships, staffing, position descriptions, and administrative processes which will optimize the utilization of available resources in achieving the educational objectives of the school system. (Author)

E2200.0160 Arthur D. Little, Inc. *Delta College, Michigan: New Construction Plan.* New York, n.d.

The Delta College study included enrollment forecasts, projections of patterns of classroom and laboratory use, analysis of innovative instructional programs and educational specifications for new construction. In each of the above areas Delta College staff and faculty worked with the ADL team. Utilization of existing facilities was one of the most critical elements in determining new building requirements. In this regard, we developed new methods of facility utilization analysis as an additional tool in the college's ongoing planning activities. (Author)

E2200.0180 Arthur D. Little, Inc. *An Eastern University: Publishing Services.* New York, n.d.

An Eastern university had under consideration a suggestion from a prominent business leader that the educational community should take steps to improve the handling of the body of valuable publications of business more generally available for educational purposes, preserve such materials for future scholarly research in economic and business history, and perhaps also serve appropriate informational interests of the non-academic community as well. ADL conducted a series of case studies with 10 of the nation's leading businesses, through top-level executives with particular ties to ADL or to the university. Business publications were classified, each class was described, and its approximate volume estimated, its potential value assessed, and the administrative problems of acquiring and processing analyzed. A specific program, responding to the educational caliber of the materials and reflecting a practical opportunity for a leading educational institution, was defined for our client's consideration. (Author)

E2200.0200 Arthur D. Little, Inc. *Graduate Theological Union: Coordination of Seminary Activities.* New York, n.d.

The Graduate Theological Union is comprised of eight theological seminaries (Protestant and Roman Catholic) located in the San Francisco Bay area. ADL was retained to identify and plan activities in the area of formal training before ordination of parish ministers and priests. The research was concerned with formulating a program of joint course instruction which would eliminate existing duplication of undergraduate instruction while preserving independent instruction by the respective institutions with respect to courses which have a unique confessional character. The study was also concerned with identifying ways in which the eight seminaries could achieve greater functional and physical coordination of their activities so as to eliminate unnecessary operating of their operating and capital expenditures. In the course of this work, computer programming was used to solve the very complex problem of developing for the eight institutions a coordinated schedule of course offerings. (Author)

E2200.0220 Arthur D. Little, Inc. *Greater New Haven Chamber of Commerce Advanced Education Committee: Industry Need for Graduate Education.* New York, n.d.

The Advanced Education Committee of the Greater New Haven Chamber of Commerce asked ADL to determine the need of management and professional workers in technically oriented industries for graduate education

programs that are conveniently available and open to full-time employees; to describe and attempt to quantify this demand; and to suggest how it might be met. While we did not feel a new graduate center to serve the New Haven area appeared justified, we made a number of specific recommendations to broaden opportunities of professional employees seeking to advance their formal training. Our recommendations ranged from dissemination to industry of more complete information on course availability, to exploration of the possibilities of ultimately establishing a modest master's program in engineering at a New Haven branch of the state university. (Author)

E2200.0240 Arthur D. Little, Inc. *A Joint Venture: Venture Appraisal.* New York, n.d.

ADL provided an outside assessment of the most forward-looking educational publishing venture contemplated by the joint venture of a diversified consumer electrical products manufacturer and a publisher–a multimedia approach for teaching language arts in the lower grades. Prime emphasis was placed on characterizing the existing audiovisual equipment population, examining the volume of audio-visual program material expenditures, and assessing the impact of federal programs. (Author)

E2200.0260 Arthur D. Little, Inc. *Junior College District 502, DuPage, Illinois: Campus Development Plan.* New York, n.d.

ADL was recently engaged to undertake a comprehensive study for development of the College of DuPage. The study was concerned with six interrelated elements of new college development:

A review and evaluation of the district's socio-economic and demographic background;

An analysis of administration and organizational patterns with recommendations which affect the college operation and development;

An analysis of the local region's economy with an examination of its occupational needs which can be met by the new college;

Detailed projections of enrollments to the year 1980;

Formulation of educational program guidelines; and

Preparation of detailed college facility needs for the first phase of development, as well as for an anticipated ultimate level of growth.

Each element of the study is important in its own right and each contributes to the critical determination of the scope of the new college and the formulation of an appropriate program of development. The sixth element, however, is the culmination of the study. The research design, the analysis of data, the findings and the recommendations result in the detailed educational specifications for the campus development. (Author)

E2200.0280 Arthur D. Little, Inc. *A Large Private University: Endowment Management.* New York, n.d.

We have been assisting the administration of a large private university to equip itself to apply modern management methods. The place of the university in our society is undergoing change and university administration has become a more complicated task as the university broadens its activities and multiplies its roles. Our work involved endowment management, inventory control and purchasing, and personnel administration.

In the endowment management area, we assisted the university with a number of long-range problems, including definition and resolution of questions relating to portfolio objectives and a survey of portfolio management methods and organizations aimed at finding the types of organization and approach most likely to lead to successful investment results. We analyzed the consequences of current programs on future financial strength, taking into account effects of restrictions imposed by gifts on expenditure of principal and on purpose. We provided a framework for long-range financial planning which takes into account the present size of the endowment, the current rate of cash drain to support operations, the planned (smoothed) rate of growth, and expected return on endowment investment. We also developed technical tools for: quantifying the desired level of portfolio risk; determining the desired balance between risk and expected return; and judging the quality of portfolio management performance. (Author)

E2200.0300 Arthur D. Little, Inc. *Long Beach Unified School District, California: Facility Utilization and Development Program.* New York, n.d.

ADL's study for the Long Beach Unified School District entailed a forecast of future enrollment and daily attendance by division, and a study of vocational education within the school district. The vocational education study led to recommendations for administrative and program changes in the vocational curricula of both Long Beach High Schools and the Long Beach Junior College. On the basis of enrollment estimates and recommended program changes, detailed physical development programs for the campuses of the Junior College were prepared. New quantitative approaches were developed for analyzing the interrelationships among enrollment, education program and physical facilities. (Author)

E2200.0320 Arthur D. Little, Inc. *Major Eastern University: Third-Generation Time-Shared Computer System.* New York, n.d.

We are working cooperatively with a major university, a major industrial laboratory, and a major computer manufacturer toward the design and realization of an information system for use in connection with a highly advanced time-sharing computer system. Our work in this area involved identification of user needs and design creation of user-oriented file systems and problem-solving tools, systems for machine-aided documentation, training of time-sharing computer users, and user-system intercommunication aids. This system represents the most comprehensive and ambitious design effort for a general purpose remote access computer 'utility' system. (Author)

E2200.0340 Arthur D. Little, Inc. *New Haven, Connecticut, Board of Education: Organization.* New York, n.d.

We were engaged by the New Haven Board of Education to conduct a study of the administrative organization of the school system. We made a comprehensive and thorough review and analysis of the emerging functional requirements of the administrative elements in the school system as they were affected by changes in population growth, social composition, educational developments, community service needs, and planned building programs. Long-range objectives were established for public education in New Haven, and a detailed reorganization plan was developed to take into account changes in grade structure in the New Haven system and to facilitate the performance of appropriate and redefined roles of teaching staff, educational specialists, administrative staff, and the Board of Education. (Author)

E2200.0360 Arthur D. Little, Inc. *Southeastern Massachusetts Technological Institute: Requirements for Facilities.* New York, n.d.

We were recently engaged in a program of assistance to the

President of the Southeastern Massachusetts Technological Institute. In this assignment we analyzed patterns of college attendance by high school students living in the area to be served by the new Institute and forecast enrollment to the year 1975. On the basis of these forecasts we projected faculty requirements and trends in student choice of major fields of study. Space requirements for each of the principal teaching departments were calculated for the ten-year planning period. In addition, forecasts were prepared for such nondepartmental space as a library, auditorium, gymnasium, and administrative facilities. As an adjunct to these preliminary studies, the need for specialized teaching equipment and the conceptual problems of establishing a research foundation at the new school were carefully considered. (Author)

E2200.0380 Arthur D. Little, Inc. *Vermont State Department of Education: Organization.* New York, n.d.

We provided assistance in the acquisition and effective utilization of professional resources necessary for improved leadership in achieving the primary objectives of the Vermont Department of Education. Our study focused on two of their five objectives:

> To facilitate educational development and accelerate the rate of constructive change in public education throughout the state.
>
> To stimulate and administer program development activities, including Federal programs and State-subsidized and administered programs, so that such developments are relevant to emerging state needs and are constructively implemented and potential advantages are exploited.

We identified the functions and the professional activities necessary to achieve these objectives; specified the kind and extent of professional and support personnel required to carry out these functions and activities; recommended desired changes in the mix of activities carried on by key personnel; recommended organizational configurations for these personnel; and explored and suggested appropriate patterns of communication and influence, both within the Department and with individuals and groups external to the Department who affect the work of the Department. We also studied the role and functions of the State Board of Education and reviewed Vermont's Education Code. (Author)

E2200.0400 Arthur D. Little, Inc. *William Rainey Harper College, Illinois: Master Development Program.* New York, n.d.

The Illinois State legislature recently enacted a law establishing the machinery for a statewide system of junior colleges. One of the earliest to be organized, William Rainey Harper College will serve a population of over 200,000 people in four townships in northwest suburban Cook County. The services of ADL were engaged to assist the college in the preparation of a master development program. This project involved a comprehensive analysis of building and program needs to provide both guidelines for the college's development and tools for continuing analysis and evaluation by its administration.

A unique aspect of this project has been the development of a computer program for the determination of educational facilities. Based on the experience of seventy-one community colleges, the program calculates the type and number of teaching spaces required to house any given enrollment level and curricula. The improved method makes it possible to determine the implications of policy decisions regarding the educational program, building assumptions, facility utilization standards, and other elements of institutional development with relative ease. This will enable the administration to spend more time concentrating on policy issues and defining the alternatives available to implement specific objectives. (Author)

E2200.0820 Kau, Manuel C.W. and Edgar, Katherine J. "School Health Services Evaluation Study Dental Findings: High Caries Rate," *Hawaii Medical Journal,* Vol. 22, No. 2 (November-December 1962), 107-109.

E2200.1000 Moo, Jen Fong, Spicer, Robert A., Edgar, Katherine J., Foster, Amy and Powell, Rene. "The School Health Services Evaluation Project–Speech and Hearing," *Hawaii Medical Journal,* Vol. 21, No. 3 (January-February 1962). 227-229.

E2200.2000 University of Maryland, University College. *Maryland Title I Newsletter.* State Agency for Title I of the Higher Educatior Act of 1965. August 1967.

Contents: 'Title I Program Proposals for Fiscal Year 1968 Now Being Accepted by the State Agency'; '1968 Annual Amendment to Maryland's State Plan'; 'Program Budget for Fiscal Year 1968'; 'Conferences and Meetings Pertinent to Title I'; 'Third Statewide Conference in Maryland on Title I'; 'Responses to Survey to Determine 1968 Maryland Community Problems'; 'Evaluation–An Important Aspect of Title I Projects'; 'The *Stapel Scale* for Evaluating Title I Seminar'; 'Evaluation Questionnaire for Title I Workshops and Seminars'; 'Title I Approved Programs for Fiscal Year 1967'; 'U.S. Office of Education Report on Unmet Title I Needs'.

PPBS

E2300.0200 Burkhead, Jesse, "The Theory and Application of Program Budgeting to Education," *Trends in Financing Public Education,* Committee on Educational Finance. Washington, D.C., National Education Association, 1965.

Discusses the problems involved in implementing a planning programming budgeting system in education.

E2300.0300 Cotton, John F. "PPBS and School Activities," draft of a speech delivered at *School Management–How to Play the Game.* A conference presented by the Government Research Council of the Miami-Dade County Chamber of Commerce, February 16-17, 1967.

Shows how programming-planning-budgeting systems can be applied to the management of a school district.

E2300.0500 Exton, Elaine. "State Legislators Urged to Install Planning-Programming-Budgeting System," *American School Board Journal,* (February 1967), 13-16.

This is a critical report on the National Conference of State Legislators which was sponsored by the National Committee for Support of the Public Schools and held in Washington, D.C., from December 4-6. The author is critical of the pressure for the acceptance of PPBS as the sole means of evaluating performance in education and asks that decisions be postponed until the results are in from pilot projects now in progress. The main dangers of PPBS at this time are seen as the possibility that the difficulty of getting funds for schools will be

increased, that PPBS might make it easy for special interest groups to get their views accepted, that Federal agencies will replace local boards in making decisions on budgeting allocations in the local schools, and that educators will be removed from their responsibilities as decision-makers in education.

E2300.0800 Hirsch, W.Z. *Education in the Program Budget.* RM-4333-RC. The RAND Corporation, Santa Monica, Calif., January 1965.

This memorandum demonstrates that government activity in the field of education can benefit from improved resource allocation through program budgeting. The study surveys the nature and scope of education in the United States, reviews the Federal budget format, develops some guidelines for the identification of education programs in relation to fiscal year 1963, and considers arrangements for the effective use of program budgeting in this area.

E2300.0820 Hirsch, Werner Z., "Education in the Program Budget," *Program Budgeting, Program Analysis and the Federal Budget,* ed. by David Novick. Cambridge, Massachusetts, Harvard University Press, 1965, p. 178-207.

The article suggests more effective ways of dealing with the Federal support of education presently originating in 42 departments, agencies and bureaus.

Planning Educational Systems

E3000.0100 Abreu, Jayme. *Obstacles to Educational Planning in Developing Countries.* Paris, United Nations, 17 October 1962.

This brief paper lists difficulties of many kinds which stand in the way of the educational planner in a developing country.

E3000.0120 Abt, Clark C. *An Educational System Planning Game.* Cambridge, Massachusetts, Abt Association, Inc., 1965.

This paper describes in detail a gaming approach to program planning for education under the constraint of a fixed budget.

E3000.0140 Arthur D. Little, Inc. *California State Board of Education: Needs and Role.* New York, n.d.

ADL undertook a state-wide study to build a basis for planning the services and organization of the California State Department of Education. The Objectives of the study were:

> To examine the role and functions of the California State Department of Education in the context of emerging requirements in the overall process of educational administration in the State, and in the light of foreseeable circumstances, goals, and problems in California education.
>
> To explore the question whether useful changes might be made in the nature, mix, extent, and cost of services provided by the Department and in the organizational arrangement employed by the Department in carrying out its functions.

The scope of the program included the study of emerging educational issues and needs that can be expected to confront school districts over the coming decades. The findings and recommendations of this study have been published in the report, 'The Emerging Requirements for Effective Leadership in California Education'. The study covered issues relating to all types of public instruction from kindergarten through the junior college level. (Author)

K3000.0160 Arthur D. Little, Inc. *Quincy, Massachusetts, School Committee: Facilities Plan.* New York, n.d.

We completed an extensive facilities planning study for the Quincy school system, determining the plant facility requirements for the next five to seven years. Particular emphasis was placed on the spatial implications of changing enrollment patterns within the community and their impact upon school location, remodeling and new construction options, school organization, and other local educational policies and standards. The economic and social forces of change were analyzed as they would affect school enrollment over time by grade and school district. After a detailed evaluation of present school plant facilities and in consultation with officials of the school system, we developed alternative ways for the city to satisfy future demand for education and to implement new educational programs and policies. (Author)

E3000.0180 Arthur D. Little, Inc. *State of Washington, A Junior College System: Policy and Plant,* New York, n.d.

In 1966 ADL completed a study which was chartered by the Washington Legislature and carried out under the direction of the State Superintendent of Public Instruction. In general the purpose of the study was to develop a comprehensive plan for a system of all existing and planned community colleges in the state. We recommended a conceptual framework to serve as a guide for the continuing development of a state-wide system of community colleges. In the course of our work we:

> Estimated the gross demographic changes and economic developments which will occur in the state in the next two decades;
>
> Forecast the kinds of services, programs, facilities and staff required for the community college system to make the maximum contribution to the state's economic development;
>
> Recommended criteria for locating community colleges and for establishing districts;
>
> Analyzed the present system of financing community colleges and recommended substantial changes, particularly for the support of occupational, vocational, and technical programs; and
>
> Recommended a new organizational system of administration, both at local and state levels. (Author)

E3000.0300 Brolin, K.G. *Statistics Needed for Educational Planning.* Paris, UNESCO, August 1963.

Lists the types of statistical data which are desirable for the preparation of educational planning programs, and shows how statistical analysis can help in the identification of educational needs.

E3000.0400 Coombs, P.H. *What Is Educational Planning?* The Fundamentals of Educational Planning: A Series of Training Booklets, Paris, International Institute for Educational Planning, n.d.

E3000.0450 Curle, A. *Educational Strategy for Developing Societies. A Study of Educational and*

Social Factors in Relation to Economic Growth. London, Tavistock Publications, 1963.

This short but useful book discusses all the questions that arise in educational planning in underveloped countries. See also the author's *The Role of Education in Developing Societies.* Accra: Ghana University Press, 1961, 33pp; and Some Aspects of Educational Planning in Underdeveloped Areas, *Harvard Educational Review,* Summer 1962, pp. 292-300. (M. Blaug)

E3000.0500 Debeauvais, M. *et al.* 'La Planification de l'Education et les Facteurs Economiques et Sociaux'. *Tiers-Monde* Tome 1, Nos. 1-2 (Janvier-Juin 1960), 27-248.

Series of articles on a variety of aspects of educational planning in its economic, social, pedagogical and institutional contexts. Articles listed separately elsewhere in relevant sections of the bibliography.

E3000.0520 Diez-Hochleitner, R. "Application of Elements of Comparative Education in the Planning of Education," *International Review of Education.* (1959), 100-10.

Proposal for utilizing operational research techniques in the production of data for educational planning.

E3000.0600 Ewers, Colin. "Educational Planning and Economic and Social Development," *International Journal of Adult and Youth Education,* Vol. XV, No. 3 (1963), 133-41.

Written particularly from the point of view of the educator, the article contains some general remarks on planning and education, followed by a list of suggested essential steps in the planning process.

E3000.0700 Fletcher, B.A. *The Planning of Education.* Researches and Studies, No. 25. University of Leeds Institute of Education, April 1963.

Discussion of the nature of planning, followed by comparative descriptions of educational planning in Eastern Europe, Western Europe and Africa.

E3000.0800 Griffiths, V.L. *Educational Planning.* The New African Library. London, Oxford University Press, 1962.

An excellent popular introduction for the many people in all kinds of positions who want to have some say in national educational policy; it assumes no prior knowledge of education or economics. (M. Blaug)

E3000.1000 The International Institute for Educational Planning. *Educational Planning: An Inventory of Major Research Needs.* Paris, IIEP, n.d.

E3000.1020 International Institute of Educational Planning. *Symposium on the Qualitative Aspects of Educational Planning.* Paris, IIEP, 1966.

The papers of this conference include: (1) W.A. Lewis, 'Economic Aspects of Quality in Education' (20pp.) which discusses various ways of evaluating educational quality in underdeveloped countries but is skeptical of both cost/benefit analysis and manpower forecasting; (2) W.H. Leff, 'A Note on the Quality-Quantity Problem in Education' (10pp.), which argues the value of a cost-benefit approach to quality without, however, discussing any of the difficulties involved; (3) H.L. Elvin, 'The Idea of Quality in Education and the Difficulty of Costing It' (19pp.), a paper sharply critical of economists' analysis of educational efficiency; (4) R.S. Peters 'Quality in Education' (28pp.), a philosophical exploration of what we mean by 'quality of education', emphasizing the multiplicity of criteria that are involved in any educational process; (5) R. Aron, 'Sociological Comments on Concepts of Quality and Quantity in Education' (26pp.), a general discussion of the problem of satisfying possibly conflicting educational objectives; (6) H. Philp, 'The Evaluation of Quality in Education' (14pp.), arguing that quality of education can be measured quantitatively, provided that the various aims of education are clearly defined; (7) T. Husen, 'Some Views on Cross-National Assessment of the 'Quality of Education' (7pp.), a brief description of an international-comparison study of the achievement of upper-secondary students in mathematics; (8) A.R. Dawood, 'Improvement of Quality in Education. Case Study of Secondary Education in India' (24pp.), a title that speaks for itself; (9) S.A. Shumovsky, 'Planification de la Qualite de l'Instruction des Ingenieurs' (17pp.), a description of engineering education in the Soviet Union; and (10) M. Conlon, 'The Concept of Quality in Education' (10pp.), some random comments on the different approaches of educators and economists to planning. (M. Blaug)

E3000.1500 Lauwerys, J.A., Bereday, G.Z. and Blaug, M. (eds.). *World Yearbook of Education 1967. Educational Planning.* London, Evans Bros., 1967.

A collection of papers on educational planning problems in both developed and developing countries. There are several general papers by (1) C.A. Anderson, M.J. Bowman, 'Theoretical Considerations in Educational Planning', a shortened version of an earlier article; (2) J. Miner, 'The Relationship of Educational and Economic Planning'; (3) P.H. Coombs, 'What Do We Still Need to Know About Educational Planning?'; and (4) J.D. Chesswas, 'The Basic Data Needed for Educational Planning'. These are followed by three papers exemplifying the 'social-demand approach' to educational planning; (5) J. Floud, 'The Robbins Report and the Reform of Higher Education in Britain'; (6) F. Edding, 'Educational Planning in Western Germany'; and (7) S. Sacks, 'Historical Trends and Present Patterns in Educational Expenditure'. The next section consists of six papers on 'the manpower-requirements approach'; (8) J.R. Gass, 'The Evolution of OECD's Approach to Educational Planning in Developed Countries'; (9) H.S. Parnes, 'The OECD Mediterranean Regional Project in Retrospect'; (10) R.G. Hollister, 'A Technical Evaluation of OECD's Mediterranean Regional Project: Methods and Conclusions', a shortened version of an earlier article; (11) H.P. Wiemaier, 'Educational Planning in Western Germany: A Case Study', a shortened version of an earlier article; (12) J.K. Folger, 'Scientific Manpower Planning in the United States'; (13) N. DeWitt, 'Educational and Manpower Planning in the Soviet Union'. Four papers provide examples of 'the cost-benefit approach'; (14) G. Hunter, 'Primary Education and Employment in the Rural Economy with Special Reference to East Africa'; (15) A. Callaway, 'Unemployment Among School Leavers in an African City'; (16) E. Rado, 'Manpower Planning in East Africa'; and (17) J.A. Smyth, N.L. Bennett, 'Rates of Return on Investments in Education: A Tool for Short Term Educational Planning, Illustrated with Ugandan Data'.

Section V is a miscellany confined to underdeveloped countries: (18) A.R. Jolly, 'Educational Planning in Zambia'; (19) S. Shukla, 'Training Educational Planners for Developing Countries'; (20) Le Thanh Khoe, 'Problems of Educational Planning in French-Speaking Africa'; (21) M. Debeauvais, 'The Development of Education in Latin America Since the Santiago Plan'; (22) G. Benveniste, 'The New Educational Technologies and the Developing

Countries'; (23) M.H. Phillips, 'Trends in Educational Expansion in Developing Countries'. Lastly, there are two papers on 'models of the educational system': (24) H. Correa, 'Models and Mathematics in Educational Planning'; and (25) P. Armitage, C.S. Smith, 'A Computable Model of the Educational System: Illustrated with British Data'. (M. Blaug)

E3000.1550 Lyons, Raymond F., "Criteria and Methods for Assessing an Educational System," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Co-operation and Development, 1963, p. 57-65.

The article discusses the preliminary task of educational planning, that of assessing the nature of the existing situation, the improvement of which is the subject of planning. Hence this is obviously an important exercise.

E3000.1570 Lyons, Raymond F., "Formulating Recommendations on Educational Needs," *Planning Education for Economic and Social Development,* Paris, Organization for Economic Co-operation and Development, 1963, p. 245-49.

A discussion of the preparation of reports to make them readily intelligible to busy politicians, and hence better able to gain a ready response to the efforts of the planners.

E3000.2000 Organization for Economic Cooperation and Development, Directorate for Scientific Affairs. *Discussion Guides and Individual Work Project.* Paris, OECD, 20 August 1962.

Formulates sets of pertinent questions on many subjects of interest to trainees in educational planning.

E3000.2020 Organization for Economic Cooperation and Development. *Seminar Syllabus.* Paris, OECD, 28 August 1963.

A series of seminar subjects referring to problems to be dealt with in the formulation of an educational plan, with discussion outlines, used at the OECD Training Course for Human Resource Strategists held in Athens in September 1963.

E3000.2100 Platt, W.J. *Conflicts in Educational Planning.* Menlo Park, Calif., Stanford Research Institute, 1962.

A discursive discussion of the conflicting goals of educational plans in underdeveloped countries. (M. Blaug)

E3000.2200 Rossello, Pedro. *L'Education Comparee au Service de la Planification.* Geneve, Delachaux et Niestle, 1959.

Indicates the dominant current trends in comparative education, and conjectures the possibility of their interrelatedness, and the need for this to be taken into account by educational planners.

E3000.2300 Solomon, E.S. *Statistical Analysis and Quantification in Educational Planning.* Paris, UNESCO, July 1963.

Discusses the role of statistical analysis in educational planning, and gives some examples of relevant statistical operations.

E3000.3000 United Nations Educational, Scientific and Cultural Organization. International Bureau of Education. *Educational Planning.* Geneva, 1962.

Results of a comparative study of educational planning activities in 75 countries, based on answers to a questionnaire, and summaries of the activities in each country.

E3000.3020 United Nations Educational, Scientific and Cultural Organization. *Educational Planning and the Provision of Education for Women and Girls.* Paris, UNESCO, 13 August 1963.

This brief and interesting paper draws attention to a factor frequently neglected, in educational planning, or at best only obtaining lip service–the relevance for development aims of the education of women. It points out the importance of women in development, and the way in which informed female opinion can contribute to the wider acceptance of measures for development.

E3000.3040 United Nations Educational, Scientific and Cultural Organization. *Elements of Educational Planning.* Educational Studies and Documents, No. 45. Paris, UNESCO, 1963.

A quick review of principles, methods and techniques of educational planning with extracts from some current plans in Asia, Africa, and Latin America. (M. Blaug)

E3000.3060 *Long-Range Educational Planning. Education Abstracts,* Vol. IX, No. 7 (September 1957), Paris, UNESCO, 1957.

A survey of educational plans, and economic plans with an educational element, giving brief details of 29 plans. The method of arriving at the targets mentioned in the plans is not given, and hence their relevance to development cannot be judged.

E3000.3080 United Nations Educational, Scientific and Cultural Organization. *The Nature of Educational Planning.* Bangkok, ECAFE, 11 March 1963.

An introductory but very concise study of the institutional framework, methodology, and relation to the economy, of educational planning. Also suggests some roles for international assistance to educational planning.

E3000.3100 United Nations Educational, Scientific and Cultural Organization. *Planning for the Education Sector.* Paris, UNESCO, 6 August 1963.

Reviews the situation of educational planning activities in Asia, and then discusses techniques for programming education in relation to economic development, mentioning their advantages. There is also an examination of problems peculiar to educational planning as distinct from development planning, and discussion of the administrative structure of educational planning, and the importance of statistical data.

E3000.3120 United Nations Educational, Scientific and Cultural Organization. *Secondary Technical and Vocational Education in Underdeveloped Countries.* Educational Studies & Documents. Paris, UNESCO, 1959.

After a general discussion of the contribution of technical and vocational education to economic growth, detailed

figures are presented and analyzed for Ghana, Brazil, and the Philippines. The study was prepared for UNESCO by the Economist Intelligence Unit in London. (M. Blaug)

E3000.3140 United Nations Education, Scientific and Cultural Organization. Statistical Division, Department of Social Sciences. *Statistics Needed for Educational Planning.* Paris, UNESCO, 6 June 1963.

Deals with the presentation and description of the various statistics needed for educational planning, dividing them into 'basic' and 'detailed' categories, according to the scale and nature of planning for which they are to be used.

E3000.3500 Wheeler, D.K. *On the Nature of Educational Planning.* Working paper. Beirut, Lebanon, Institute for Educational Administration, n.d.

Discusses particularly the human problems involved in the educational planning process, which have to be considered to ensure the efficiency of planning administration.

Forecasting Needs

E3100.0100 Arthur D. Little, Inc. *New Jersey College of Medicine and Dentistry: Estimates of Future Space Needs and Costs.* New York, n.d.

ADL was asked to assist the New Jersey College of Medicine and Dentistry to establish the timing, cost and extent of new facilities to be constructed at a new site. Detailed interviews were held with the faculty and administration to determine forthcoming curriculum changes, the special needs for interdisciplinary approaches to the teaching of medicine and dentistry, the functional relationships between departments, and the special needs of each department. Estimates of student and faculty contact hours provided a basis for space estimates. The cost of the new space and the staging of construction in light of fund availability were also provided. (Author)

E3100.0300 Campbell, R. and Siegel, B.N. *The Demand for Higher Education in the United States, 1919-1964.* Center for the Advanced Study of Educational Administration. Eugene, Oregon, University of Oregon, 1966.

A path-breaking paper which demonstrates that, for a given population, enrollment demand has varied positively with the expected yield from education, positively with income, positively with the consumer price index, and negatively with the costs of education. (M. Blaug)

E3100.1000 Liu, B.A. *Estimating Future School Enrollment in Developing Countries. A Manual of Methodology.* Statistical Reports and Studies. Paris, UNESCO, 1966.

Apart from a discussion of the kinds of methods generally employed in most countries, this monograph includes three case studies of enrollment projections in Colombia, Philippines and Sudan and illustrative examples of actual projections in New Zealand, France and the United States. (M. Blaug)

E3100.2000 Tinbergen, J. and Bos, H.C. "The Global Demand for Higher and Secondary Education in the Underdeveloped Countries in the Next Decade," *Policy Conference on Economic Growth and Investment in Education, Part III.* Paris, Organization for Economic Cooperation and Development, 1962, p. 71-80.

Some preliminary estimates, with indications of the methodology used, of requirements for teachers in relation to expected numbers of students.

E3100.3000 Vaizey, J. "Forecasts and Projections," *The Control of Education.* London, Faber & Faber, 1963, p. 99-142.

A review of forecasts the author made at various times (1953, 1954, 1958, 1959, 1960) of enrollment and educational expenditures in the U.K., all of which underestimated the actual figures because of erroneous population and price forecasts. In the light of this fact, the author discusses the value of these types of forecasts. (M. Blaug)

Manpower Requirements Methods

E3200.0100 Arthur D. Little, Inc. *Central Hudson Gas and Electric Corporation: Role of Higher Education in Area Development.* New York, n.d.

For the Central Hudson Gas and Electric Corporation, we studied the role of higher education in the development of the Mid-Hudson Region and made recommendations with respect to immediate and long-range action. Recognizing the need to know more about the implication of higher education to the future of the region as a basis for public decision and consensus as to what should be done to achieve a balanced development, they asked us to:

Assess the demand for graduate and professional training among the residents and employees in the region.

Determine the extent to which these needs are now being met by institutions and major employers in the area.

Suggest means of meeting the needs that do not appear to be adequately met.

Project educational requirements and suggest the means by which higher educational services should be expanded to meet these projected needs.

Relate the region's needs and the suggested institutional solutions to the projected overall needs of the State so that the solutions suggested will be responsive not only to regional needs, but also to the State's requirements.

Analyze and evaluate the role which strengthened higher educational institutions may play in the future economic, social, cultural, and environmental development of the Mid-Hudson Region. (Author)

E3200.0200 Beckerman, Wilfred, *Methodology for Projection of Educational Requirements.* Paris, Organization for Economic Co-operation and Development, 14 March 1962.

A comparison of two criteria for deciding educational requirements–the social objectives method and the manpower requirements method.

E3200.0220 Beckerman, Wilfred, "Projections and Productivity Concepts," in *Planning Education for Economic and Social Development,* Paris, Organization for Economic Cooperation and Development, 1963, p. 105-112.

One of the inter-relations implicit in the manpower approach to educational planning is that between output and manpower requirements. This involves assumptions as to labour productivity, and this paper therefore devotes some attention to examining this latter concept and its measurements.

E3200.0240 Bernard, Jean, *Analyse des Relations Entre Production, Travail et Education a l'Aide d'un Modele Dynamique d'Optimation.* Centre d'Etude de la Prospection Economique a Moyen et Long Ternes, September 1965.

E3200.0260 Blandy, R., "Some Questions Concerning Education and Training in the Developing Countries," *International Labor Review,* (December 1965), 476-490.

This paper draws attention to some of the anomalies that have arisen as a result of the manpower-forecasting approach to educational planning in developing countries. Among the remedies discussed by the author is the adoption of an occupational classification scheme based, not on job-content, but on the education and training required for the occupation. (M. Blaug)

E3200.0280 Bowman, M.J., "The Requirements of the Labour-Market and the Education Explosion," *The Education Explosion. World Year Book of Education 1965,* eds. G.Z.F. Bereday, and J.A. Lauwerys. London, Evans Bros., 1965, p. 64-81.

Presents and discusses rate-of-return evidence for the United States, India, Mexico, followed by a typology of educational explosions around the world. The basic thesis of the article is that the recent expansion in the private demand for education is explainable on economic grounds. (M. Blaug)

E3200.0300 Debeauvais, Michel. "Methods of Forecasting Long-Term Manpower Needs," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, p. 85-96.

A discussion of the forecasting stage in educational planning, as far as it concerns manpower, together with an examination of the difficulties involved.

E3200.0340 Doos, Sten-Olof, "Forecasting Manpower Requirements by Occupational Categories," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, p. 123-37.

An examination of a further inter-relation in the manpower approach to educational planning–that between occupational categories and their educational requirements–and the relation of these two classifications in turn to the industrial structure.

E3200.0800 Harbison, F.H. and Myers, C.A. Education, Manpower and Economic Growth. *Strategies of Human Resource Development.* New York, McGraw-Hill, 1964.

The authors develop a composite index for ranking 75 countries into four levels of human resource development, in the light of which they analyze appropriate policies and strategies of human resource development, stressing the role of informal as well as formal education. The basic chapter on 'Quantitative Indicators of Human Resource Development', pp. 23-49, is reprinted and discussed in *International Economic Association Conference on the Economics of Education.* London: Macmillan, 1965. Chs. 4-6, pp. 49-131, deal with the developing countries. Ch. 7, pp. 131-171, deals with the problems of developed countries. The discussion is drawn together in ch. 8, pp. 173-189. Ch. 9 on 'Establishing Human Resource Targets', pp. 189-209, is full of sensible comments on manpower planning. The book closes with a chapter on the 'Integration of Human Resource and General Development Planning', pp. 209-225. (M. Blaug)

E3200.0820 Harbison, F.H. and Myers, C.A. (eds.). *Manpower and Education: Country Studies in Economic Development.* New York, McGraw-Hill, 1964.

This volume contains eleven papers on high-level manpower planning in Latin America, Asia, and Africa: M.A. Horowitz on Argentina; W.F. Whyte on Peru; R.C. Baldwin on Chile; W.H. Knowles on Puerto Rico; G.B. Hsu on Communist China; E.J. Berg on Senegal, Guinea and the Ivory Coast; G. Seltzer on Nyasaland; R.L. Thomas on Uganda; and G. Hunter on East Africa and Southeast Asia. (M. Blaug)

E3200.1000 Lubin, Isador and Dollard, Charles, (eds.). *Human Resources. Training of Scientific and Technical Personnel.* Washington, D.C., U.S. Government Printing Office, 1963.

A collection of papers prepared by the United States for the U.N. 'Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas', 1963, dealing with a variety of themes of interest to the educational planner.

E3200.1100 Mechner, Francis and Cook, Donald A. *Behavioral Technology and Manpower Development.* New York, Basic Systems, Inc., December 1963.

The authors describe the evolution of behavioral technology and its uses in setting up learning programmes and elucidating the educational requirements of different types of manpower. Examples are given of the work of setting up a programme.

E3200.1140 Moser, C.A. and Redfern, F. "Education and Manpower: Some Current Research," *Models for Decision,* Bermers, L. and Conway, N., (eds.), English University Press, July 1965.

E3200.1180 Muntz, E.E. "Education and Scarcity in the Top Level Labor Force in the United States," *Journal of Educational Sociology,* (October 1959), 105-123.

One economist's recommendations for repairing the present educational imbalance in the U.S.A. (M. Blaug)

E3200.1400 Organization for Economic Cooperation and Development. *Country Reviews. Policies for Science and Education.* Paris, OECD, 1962.

Country reviews are carried out periodically in each of the OECD member countries as a means of assessing current progress in educational planning, with special reference to the supply of high-level manpower. The standard procedure for the Reviews is for two or three experts from other Member countries to visit the country under review, report their findings, and draw up a list of

questions which are then debated at a special plenary meeting of the OECD Committee for Scientific and Technical Personnel. So far five Reviews of this kind have been published: *Yugoslavia* (62pp.); *Norway* (53pp.); *Denmark* (61 pp.); *Sweden* (74pp.); *Greece* (62pp.). Along similar lines, there is also *Higher Education and the Demand for Scientific Manpower in the U.S.A.* (1963, 101pp.) and *Scientific Policy in Sweden* (1964, 66pp.). In every case, valuable data is included in the Reviews. (M. Blaug)

E3200.1420 Organization for Economic Cooperation and Development. *Policies for Science and Education, Country Reviews. – Sweden.* Paris, OECD, 1962.

Description of manpower forecasting for scientists and engineers in Sweden, which is the basis of planning relevant higher education. Discussion of types of plan.

E3200.1500 Parnes, Herbert S. *"Manpower Analysis in Educational Planning," Planning Education for Economic and Social Development,* Paris, OECD, 1963, p. 73-84.

An evaluation of the manpower approach to educational planning is followed by a description of its methods.

E3200.1540 Peacock, A.T. "Economic Growth and the Demand for Qualified Manpower," *District Bank Review,* (June 1963), 3-19.

The author warns against the pitfalls in the manpower–forecasting approach and calls for more study of the relative rates of return to various forms of higher education in Great Britain. The argument is illustrated by the work of the Advisory Council on Scientific Manpower and of N.E.D.C. (M. Blaug)

E3200.2000 Tinbergen, J. *Education Planning Manual.* Paris UNESCO, 15 July 1962. Draft chapters for the *Handbook on Economic and Social Aspects of Educational Planning.*

In these chapters the author sets out a methodology for educational planning, via the medium of manpower requirements.

E3200.2020 Tinbergen, J. and Bos, H.C. "The Global Demand for Higher and Secondary Education in the Underdeveloped Countries in the Next Decade," *Policy Conference on Economic Growth and Investment in Education, III: The Challenge of Aid to Newly Developing Countries.* Paris, Organization for Economic Cooperation and Development, 1962, p. 71-81.

Owing to lack of knowledge of manpower-output ratios in underdeveloped countries, this projection for 1970 is based on desirable increases in income per head and the expansion of education required to meet these desirable targets. The interesting discussion that followed this and other papers concludes with 'ten commandments of educational assistance' (pp. 96-97). (M. Blaug)

E3200.2500 Vaizey, J. "Some of the Main Issues in the Strategy of Educational Supply," *Policy Conference on Economic Growth and Investment in Education, III: The Challenge of Aid to Newly Developing Countries,* Paris, Organization for Economic Cooperation and Development, 1962. Reprinted in a fuller version in J. Vaizey, *The Control of Education.* London, Faber & Faber, 1963, p. 35-89.

A general discussion of educational problems in underdeveloped countries, full of incisive comments on a large number of topics: manpower planning, rural education, private education, women's education, planning assistance, overseas students, and teachers' supply. (M. Blaug)

E3200.2700 Williams, Gareth. *Projecting Manpower Requirements and the Use of Educated Manpower in Agriculture.* Paris, Organization for Economic Cooperation and Development, 19 November 1963.

The author mentions some special features of agricultural manpower but emphasizes the advantages of integrating agricultural and rural education, differentiating these two, into general educational planning.

For Economic Growth

E3300.0200 Beckerman, Wilfred. "Long-Term Projections of National Product," *Planning Education for Economic and Social Development,* Paris, Organization for Economic Cooperation and Development, 1963, p. 97-103.

The article advocates the usefulness of projections of economic growth, as distinct from forecasts, as an aid to educational planning.

E3300.0220 Bowman, Mary Jean. *The Shaping of Economies and Men.* Chicago, Committee on Economic Growth, Social Science Research Council, 1963. Paper given at the Conference on Education and Economic Development, Comparative Education Center, University of Chicago, 4-6 April 1963.

This widely-ranging interdisciplinary study offers an extensive review of the relation between education and economic development based on the work of many authors, and offers some challenging ideas on the subject. The adoption of the various well-known development strategies for educational planning in order to ensure its maximum utility is also discussed.

E3300.0300 Correa, H. *Educational Planning: Its Quantitative Aspects and its Integration with Economic Planning.* Paris, International Institute of Educational Planning, 1965.

E3300.0320 Correa, H. and Tinbergen, J. "Quantitative Adaptation of Education to Accelerated Growth," *Kyklos,* Vol. XV, No. 4 (1962), 776-785.

Simplified version of the Correa model, solved by plugging in plausible values for certain co-efficients. The model assumes: (1) there is a fixed relationship between level II and III graduates and physical output; (2) all three levels of education last six years each; (3) all level II teachers are level III graduates; (4) there is full employment; (5) output grows at a constant exponential; (6) capital and educated labor are complementary factors; (7) educated labor is perfectly substitutable between broad classes of occupations. (M. Blaug)

E3300.0400 Debeauvais, M., (ed.). "Colloque International sur la Planification de l'Education et ses Problemes Economiques et Sociaux,"

Tiers-Monde. Problemes des Pays Sous-Developpes, (janvier-juin, 1960), 27-251.

Reports and proceedings of a conference held in Paris in 1959, with an introduction and a summing-up by the editor. The papers are grouped under three headings: economic factors, sociological factors, and pedagogic factors. Under the first heading, C. Bettelheim, H.L. Elvin, B.F. Hoselitz, and J. Vaizey deal in general terms with the problems of underdeveloped countries, while F.V. Garmonov writes on the USSR, W. Ozga on Poland, and A.M. Kardan with J.E. Naraghi on Iran. An article by E. Lobel on 'Problems of Finance' is reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey. Paris, UNESCO, 1964. (M. Blaug)

E3300.0500 Edding, F. *Internationale Tendenzen in der Entwicklung der Ausgaben fur Schulen und Hochschulen. Kieler Studien, No. 47.* Kiel, Instituts fur Weltwirtschaft an der Universitat Kiel, 1958, p. 164, 156.

An international comparison of 18 countries over the first half of this century, relating public spending on education to some key indicators of development, particularly national income. Establishes an income elasticity of demand for education in excess of unity and shows that 5% seems to be the ceiling level for the proportion of total income devoted to public education. An English version of the conclusions (pp. 157-164, reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey. Paris: UNESCO, 1964) and English table-headings in the statistical appendices make this a valuable source for data, even for those who read no German. (M. Blaug)

E3300.0520 Eide, K., 'Educational Developments and Economic Growth in OECD Member Countries," *International Economic Association Conference on the Economics of Education.* London, Macmillan, 1965, p. 174-202.

This paper consists of three unconnected parts: the first part analyzes the situation with respect to highly qualified manpower in the OECD areas in 1959; the second discusses various approaches to educational planning; and the third reviews the work of OECD in the manpower area. (M. Blaug)

E3300.0700 Galbraith, J.K. *Economic Development in Perspective.* Cambridge, Mass., Harvard University Press, 1962.

In this series of lectures the author discusses a number of themes in economic development, including the relation of education.

E3300.0800 Hanson, J.W. and Brembeck, C.S. (eds.). *Education and the Development of Nations.* New York, Holt, Rinehart & Winston, 1966.

Reprints some 50 articles and papers covering the entire spectrum of attitudes to the role of education in social and economic development. Most of the contributions are rather superficial. The items on the economics of education are Nos. 46, 87, 444, 528, 549, 612, 662. Useful bibliographical references, particularly to lesser known minor items in educational journals, are to be found scattered through the book: pp. 8-9, 42-3, 74-5, 98-9, 114-5, 158-9, 187-9, 223-4, 247-8, 273-4, 301-2, 347-9, 397-400, 444-6, 463-4, 496-8, 509-10. (M. Blaug)

E3300.0830 Institut d'Etude du Developpement Economique et Social. *Le Developpement Planifie des Ressources Humaines.* Paris, IEDES, 10 Septembre 1962.

Discusses the planned development of education in close context with economic development, showing ways in which the two may be integrated.

E3300.0900 International Association of Universities. *Some Economic Aspects of Educational Development in Europe.* Paris, International Universities Bureau, 1961.

The summary and papers of a conference held in 1960 to discuss the future progress of education, particularly in relation to economic growth, and the planning requirements deriving therefrom.

E3300.0920 Iribarne, Fraga. "Fracteurs Sociologiques dans l'Elaboration d'un Systeme d'Education," *Tiers-Monde,* Tome 1, Nos. 1-2 (janvier-juin 1960), 145-155.

Article points out the need for a planned educational system to be set within the existing social structure and fashioned to facilitate its evolution towards development. Hence the sociological aspects of any educational plan are important factors in its success.

E3300.1000 Karmel, P.H. *Some Economic Aspects of Education.* Melbourne, F.W. Cheshire, 1962.

After some general remarks on education and economic development, including some cogent remarks on manpower planning, the author turns to Australian Census data revealing a rise in educational efforts. He notes that Australia ranks high in per capita income but relatively low in the proportion of total income devoted to education, and rejects the view that this denies the contribution of education to Australian development. He closes the pamphlet with a plea for additional expenditures on education. (M. Blaug)

E3300.1020 Kaser, M.C. *Patterns of Education in Economic Growth and Cultural Change.* Paris, UNESCO, 23 June 1964.

An outline of a project, prepared by the author as consultant to the UNESCO Division of Social Sciences, intended, first, to carry further techniques of measuring the pattern of education; secondly, to set up interpretive histories of education in selected high-income countries, and, thirdly, to associate such case studies with measures of economic growth. Lacunae are indicated in the educational statistics required for cost/benefit analysis, but the need for cultural assessments as a benefit variable is recognized; lines are suggested for developing Sander's work on curricula classification and relating it meaningfully to Debeauvais on dropouts, repeats and sequential barriers, and the problem raised of changes in curricular structure in relation to parameters of organization; measures of the territorial spread of schools of educational finance and of intraschool efficiency (streaming data and examination results) are considered. The data required for the case histories are briefly reviewed in the light of the information needed to compose the aggregates and to provide a minimal stratification.

E3300.1400 March, G.B., (ed.). *Occupational Data Requirements for Educational Planning: Proceedings of a Conference at the University of Wisconsin.* Wisconsin, Center for Studies in Vocational and Technical Education, 1966.

This collection of papers, and the discussion which followed them, reveals important differences of opinion among the participants on the importance and value of manpower data and projections for educational planning. R.N. Evans argues the need for better occupational data (pp. 1-18), but participants questioned the costs involved, and argued that a more pressing need was for analysis of existing data. B. Weisbrod speaks of the difficulty of defining manpower 'needs' in the absence of data on rates of return (pp. 33-40), and also questions the distinction between vacational and non-vocational education. D.A. Schon describes the extent of forecasting within U.S. government departments (pp. 42-51). S.C. Kelley reviews the work of M.R.P. (pp. 60-83), and W.J. Platt describes the use of international comparisons of the educational stock of the labor force (pp. 84-101). Some interesting comments on these papers were made by W.G. Bowen, H.S. Parnes, and F. Harbison (pp. 105-113). Finally, S.A. Levitan surveys manpower and occupational data in the U.S., but denies that occupational projections should be given top priority (pp. 126-138). M.S. Joseph also argues that manpower forecasters should not attempt to make longer and more detailed forecasts of manpower needs without more research into questions of substitutability, and the role of wage adjustments in the labor market (pp. 161-165). (M. Blaug)

E3300.1700 Organization for Economic Cooperation and Development. *Organizational Problems in Planning Educational Development.* Paris, OECD, May 1966.

Examines some administrative problems in educational planning; the role of educational plans in economic and social development programmes; manpower requirements and educational organization; resource requirements and educational obsolescence; centralization versus decentralization in education; and research on educational organization.

E3300.1720 Organization for Economic Cooperation and Development, Directorate of Scientific Affairs. *Handbook of Statistical Needs for Educational Investment Planning, With Some Proposals for International Comparisons.* Paris, OECD, 1966.

After an introductory chapter, the demand-for-places and the manpower-forecasting approaches are discussed in some detail in Chapters 2, 3, and 4. Ch. 5 develops a set of tabulations out of the conclusions of the previous chapters. Ch. 6 considers the question of data collection. Ch. 7 deals with international comparisons. Ch. 8 is devoted to the financing of education and the estimation of educational expenditures. The final chapter discusses proposals for future work. Several annexes deal with data-collection experience in various OECD Member Countries. (M. Blaug)

E3300.1740 Organization for Economic Cooperation and Development, Directorate for Scientific Affairs. *Lectures and Methodological Essays on Educational Planning: Lectures Given at the Human Resources Development Training Course.* 1964. Paris, OECD, 1966.

The lectures given at a course for OECD Human Resource Fellows, consist of C.A. Myers, 'The Role of Education in Economic Growth', which reproduces material from an earlier article; F.H. Harbison, 'Strategies of Planning by Case-Studies of Nyasaland, Colombia, China and Egypt'; S. Mardin, 'Social Factors Affecting Educational Reforms', dealing with the social demand for education in Turkey; J. Vaizey, 'Financial and Policy Implications of Educational Plans', which predicts a period of financial stringency for education in most countries in the 1970's and discusses methods of financing education expansion; L. Tabah, 'Demographic Aspects of Educational Planning', which deals with population trends in developing countries; and J. Tinbergen, 'Projections of Output and Employment', which describes in outline the Tinbergen model. The second part of the volume consists of five more detailed methodological papers: L.J. Emmerij and H.H. Thais, 'Projecting Manpower Requirement by Occupation'; J.L. Blum, 'Skill Acquisition and Development'; H.S. Parnes, 'Labour Force Mobility'; C. Van Dijk, 'The Operating Costs of Education'; and H.H. Thais, 'Regional Aspects of Educational Planning'. These papers give detailed information of some of the work done by M.R.P. teams. (M. Blaug)

E3300.1760 Organization for Economic Cooperation and Development. Directorate for Scientific Affairs. *Programme on Educational Investment and Planning: Fourth Meeting of Directors and Representatives of National EIP Groups.* Paris, OECD, 13 November 1963.

A brief description of the conceptual framework and working methods of the EIP programme.

E3300.1780 Organization for Economic Cooperation and Development, Directorate for Scientific Affairs. *Programme on Educational Investment and Planning: Progress and Policy Report.* Paris, OECD, 20 November 1963.

This paper briefly outlines the directions in which research is proceeding in the EIP programme.

E3300.1800 Organization for Economic Cooperation and Development. *The Residual Factor and Economic Growth.* Paris, OECD, 1964.

E3300.2000 Parnes, H.S. (ed.). *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1964.

Twenty-one lectures presented in 1962 at an O.E.C.D. Training Course for Human Resource Strategists. Three broad subjects were covered: education and economic growth; the manpower requirements approach to educational planning; and the formulation and costing of educational targets. Under the first heading, S.G. Kelley speaks on 'The Role of Incentives in Human Resource Planning' (pp. 27-37), J. Vaizey pours cold water on the rate-of-returns approach to the economic contribution of education, concluding that 'education, as such, has historically-speaking probably been more opposed to growth than it has supported it'. (pp. 39-47). J.W. Saxe comments along similar lines. R.F. Lyons addresses himself to 'Criteria and Methods for Assessing an Educational System' (pp. 57-65). Under the second heading, H.S. Parnes contributes an excellent defense of the manpower-forecasting approach, followed by a list of the successive steps in ascertaining the required expansion of the educational system (pp. 73-84), M. Debeauvais discusses 'Methods of Forecasting Long-Term Manpower Needs', arguing for a broad occupational classification into six levels corresponding to their respective educational requirements (pp. 85-96), W. Beckerman differentiates 'forecasts' from 'projections' and discusses various ways of measuring labor productivity by way of estimating the future manpower needs of a given sector of the economy, (pp. 97-112), N. Novacco goes over the same grounds in the light of Italian experience (pp. 113-122), S.O. Doos carefully distinguishes between the industrial, occupational, and educational dimensions of manpower and elaborates on the second of these (pp. 123-137), N. Erder describes the methods that have been used in Turkey to estimate future manpower requirements by occupations (pp. 139-146),

H.S. Parnes comes back to the educational dimension, emphasizing that it is impossible to uniquely associate each occupational category with a different level and type of required education (pp. 147-157) and, lastly, there is the paper by Tinbergen and Correa, reprinted from *Kyklos.* Under the third heading H.L. Elvin comments on the adaptation of an educational system to the cultural characteristics of a society and then moves on to analyze specific ways of remedying a teacher shortage (pp. 117-193), Yugoslav, French and Spanish planning experience are discussed in turn by H. Haas, R. Poignant, and J.T. Artigas (pp. 195-231), F. Edding discusses the calculation of the costs of a recommended programme of educational expansion (pp. 233-244), and R.F. Lyons deals with the practical problem of how to formulate and present an educational plan (pp. 245-249). The volume closes with a statement of some selected research proposals by participants in the course (pp. 261-270). (M. Blaug)

E3300.2020 Pauvert, J.C. "Facteurs Sociologiques de la Planification de l'Education," *Tiers-Monde,* Tome 1, Nos. 1-2 (Janvier-Juin 1960), 135-44.

The article emphasizes the need to take into account the influence of social phenomena on the effectiveness of educational planning, and conversely the effect of planning of these phenomena–various social groups, social mobility, acculturation, etc.

E3300.2040 Phillips, H.M. *Education and Development.* Paris, UNESCO, 25 June 1963. (Draft chapter for *Handbook on Economic and Social Aspects of Educational Planning.)*

A wide-ranging introductory study of education in economic and social development, which considers in some detail the problems of integration of educational planning into development planning.

E3300.2060 Poignant, R. *The Relation of Educational Plans to Economic and Social Planning.* The Fundamentals of Educational Planning: A Series of Training Booklets. Paris, International Institute for Educational Planning, April 1967.

E3300.2080 "Problems of Planning," *Public Policy,* Cambridge, Massachusetts, Harvard University Press, 1965, p. 161-235.

Contents–'Rate of Return' vs. Manpower Approach in Educational Planning by Andre Daniere. Recent Discussion of the Problems of Higher Education in Great Britain, by Lord Robbins. Some Economic Problems of Education Expenditures on Education and Income Levels, by Seymore E. Harris.

E3300.2200 Sen, Amartya K. *A Planning Model of Education Requirements of Economic Development: Some Comments.* Paris Organization for Economic Cooperation and Development. 18 April 1963.

Considers the Tinbergen approach to educational planning as analogous to the planning of capital goods' requirements, and evaluates Tinbergen's work accordingly. In conclusion it is suggested that this approach is better adapted to elucidating minimum requirements for educated people rather than optimum requirements.

E3300.2300 Tinbergen, J. *Economic Planning.* Rotterdam, Netherlands Economic Institute, Division of Balanced International Growth, July 1963. Draft of a book to be published by Yale University Press, 1964.

Discussion of the economic planning process and its place in development with frequent references to the place of educational planning within this framework. Also useful in that remarks about the structure and purpose of economic planning activity can be applied by analogy to educational planning in many instances.

E3300.2320 Tinbergen, J. "Educational Assessment," *Economic and Social Aspects of Educational Planning,* Paris, UNESCO, 1964.

E3300.2340 Tinbergen, J. "The Place of Education in the Economy," *Giornale Degli Economisti,* (Gennaio-Febbraio, 1960), 3-12.

In this highly theoretical and difficult article, Tinbergen sketches a complete theory of private and social decision-making in education. (M. Blaug)

E3300.2360 Tinbergen, J. *A Planning Model of Education Requirements of Economic Development.* Paris, Organization for Economic Cooperation and Development, 18 March 1963.

A model, much simplified, of the relations between national production, manpower requirements, and the educational structure, is presented as a method of educational planning, and it is shown how it can be used to produce solutions to a variety of problems. The question remains of the amount of modification needed for its applicability to actual situations.

E3300.2380 Tinbergen, J. "Quantitative Adaptation of Education to Accelerate Growth," *Planning Education for Economic and Social Development,* Paris, Organization for Economic Cooperation and Development, 1963, p. 159-165.

The author's first educational planning model, superseded by subsequent ones included in the bibliography.

E3300.2400 Tinbergen, J. "Die Unterrichtsplanung im Rahmen der Allgemeimen Wirtschaftsplanung," *Gedenskschrift fur Machenroth,* Kaptial 14.

E3300.2420 Tinbergen, J., *et al. Planning Models of Educational Requirements for Economic Development.* Paris, Organization for Economic Cooperation and Development. 9 September 1963.

The latest version of the main author's model for planning educational requirements for economic development, together with applications of it to Spain, Greece and Turkey. In conclusion Professor Tinbergen discusses objections to the methodology employed.

E3300.2440 Tinbergen, J. and Bos, H.C., "A Planning Model for the Educational Requirements of Economic Development," *Econometric Models of Education, Some Applications,* Paris, Organization for Economic Cooperation and Development, 1965, Part I, p. 9-31.

This paper discusses a model for the planning of education. It includes various earlier, simpler versions as well as more elaborate, recent ones. The model is intended to represent the link between economic development and that of the

educational system of a nation.

Educational development must show both qualitative and quantitative aspects; the former refer to changes in methods of teaching and the subject matter of teaching; the latter refers to changes in the dimensions and the composition of the educational system. This study disregards the qualitative aspects except when combined with the quantitative, e.g., in the numerical values of some coefficients. (Authors)

E3300.2460 Tinbergen, J. and Bos, H.C., "An Appraisal of the Model and the Results of Its Application," *Econometric Models of Education, Some Applications,* Paris, Organization for Economic Cooperation and Development, 1965. Part V, p. 95-99.

E3300.2800 United Nations Educational, Scientific and Cultural Organization. *Education for Community Development. A Selected Bibliography.* Paris, UNESCO, 1954.

Annotated bibliography covering general works on the theory and practice of community development and descriptive material on individual projects. (M. Blaug)

E3300.2820 United Nations Educational, Scientific and Cultural Organization. *Handbook on Economic and Social Aspects of Educational Planning.* Paris, UNESCO, 1964.

This volume opens with an excellent review by H.M. Phillips of the basic characteristics of educational planning and the five or six different approaches to planning that are current in the literature. This is followed by a paper on 'Human Resource Development and National Planning' by F.H. Harbison, which touches skillfully on the conflict between the economic and the humanistic attitude to educational planning. Another essay by Harbison deals with procedures for estimating future manpower requirements, duplicating Ch. 9 of *Education, Manpower and Economic Growth. Strategies of Human Resource Development,* by F.H. Harbison and C.A. Myers. N.Y.: McGraw-Hill, 1964. R. Dietz-Hochleitner writes on educational planning in general, including the organizational, administrative, and financing aspects. A. Sauvy provides a brief analysis of 'Social Factors in Educational Plans', particularly the effect of education on social stratification. G. Skorov discusses the 'Manpower Approach to Educational Planning: Methods Used in the Centrally Planned Economies', illustrating the techniques employed in the USSR. 'Statistical Analysis and Quantification in Educational Planning' by E.S. Solomon describes methods of quantifying and costing educational plans with examples from African and Latin American experience. K. Brolin shows what are the 'Statistics Needed for Educational Planning', filling a long-neglected gap in the literature. A long paper by J. Tinbergen develops the manpower approach he has outlined in other works with particular attention to the question of plan-revisions after observation of actual developments; an appendix contains some practical rule-of-thumb methods for planners. Similar practical considerations motivate the essay by C. Ewers on 'Project Analysis and Programming for International Finance'. Lastly, there is a long 'Selected Bibliography', particularly useful for its coverage of Soviet literature. (M. Blaug)

E3300.3000 Vaizey, John. "Introduction to Economics of Education," *International Social Science Journal.* Vol. XIV, No. 4, Part 1 (1962), p. 619-32.

An introductory article to a symposium on the economics of education, it explores some aspects of the relation of education and its planning to development.

For Economic Growth

In Developing Countries

E3310.0100 Asher, Robert E., *et al. Development of the Emerging Countries, An Agenda for Research.* Washington, D.C., The Brookings Institution, 1962.

A series of essays outlining directions for research and action in various aspects of development. No. 5, by Mary Jean Bowman and C. Arnold Anderson, deals specifically with the role of education in development. Education and development is also mentioned in essays nos. 3 and 4.

E3310.0200 Bos, H. and Cornelisse, P.A. *Financial Aspects of the Educational Expansion in Developing Regions.* Organization for Economic Cooperation and Development. Meeting on the Financing of Education for Economic Growth. Paris, September 1964.

E3310.0250 Lederman, Esteban. *Estudio de la Situacion Actual y Demanda Futura de dos Profesiones Universitarias.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E3310.0300 "Symposium on Education and Development," *Comparative Education Review, (June 1964), 5-40.*

The symposium consists of the following five papers: (1) F.H. Harbison, C.A. Myers, 'Education and Employment in the Newly Developing Economies', pp. 5-10; (2) H. Correa, 'Quality of Education and Socio-Economic Development', pp. 11-16; (3) R. Jacobs, 'The Interdisciplinary Approach to Educational Planning', pp. 17-27; (4) R. Heifetz, 'Manpower Planning: A Case Study from Puerto Rico', pp. 28-36, reprinted from *International Labor Review;* and (5) H.H. Smythe, N. Sasidhorn, 'Educational Planning in Thailand', pp. 37-40. (M. Blaug)

E3310.0350 Curle, Adam. "Some Aspects of Educational Planning in Underdeveloped Areas," *Harvard Educational Review,* Vol. 32, No. 3 (Summer 1962), 292-300.

An important article on the relation of education to development, in which the author suggests the replacement of the dichotomy between consumption and investment education with a distinction between short-run and long-run investment in education. The importance of close integration between educational and economic planning is brought out, particularly in relation to the need to increase a country's absorptive capacity for educated people.

E3310.0500 Elliot, W.Y. (ed.) *Education and Training in the Developing Countries: The Role of U.S. Foreign Aid.* New York, F.A. Praeger, 1966.

A collection of thirty papers describing and assessing American contributions to educational programmes in Africa, Asia, and Latin America. There is some examination of general problems of educational planning in underdeveloped countries, and of the roles of the U.S. government, universities, and private foundations, in providing financial and technical assistance, as well as

discussion of specific subjects such as the Ashby Report in Nigeria (pp. 108-132) and training needs in India (pp. 231-241). (M. Blaug)

E3310.0520 Enke, S. *Economics for Development.* Englewood Cliffs, New Jersey, Prentice-Hall, 1963.

This is the first of the dozen or so recent American college textbooks on economic development to deal explicitly, and at some length, with educational investment in backward countries. The approach adopted by the author is that of raising questions instead of attempting to provide answers. (M. Blaug)

E3310.0800 Hanna, Paul R. "Education as an Economic and Social Instrument in the Newly Developing Nations," *Phi Delta Kappan,* Vol. XLIII, No. 8 (May 1962), 354-56.

This brief article is useful in indicating some past and current research projects at Stanford University relating to education and economic development. Similar studies might be relevant to the research work of national educational planning agencies.

E3310.0820 Harbison, F. *Educational Planning and Human Resource Development.* Paris, UNESCO, International Institute of Educational Planning, 1967.

This pamphlet consists of two essays: (1) 'Priorities and Choices in Human Resource Development,' pp. 11-22, a general discussion of the kinds of choices that face all educational planners in low-income countries; and (2) 'Systems Analysis Approach to Human Resource Development Planning,' pp. 25-34, a brief attempt to divorce educational planning from purely quantitative forecasts. (M. Blaug)

E3310.0840 Harbison, F.H., "The Strategy of Human Resource Development in Modernizing Economies," *Policy Conference on Economic Growth and Investment in Education,* Part 3. Paris, Organization for Economic Cooperation and Development, 1962, p. 9-33.

A discussion of the relation of education to development as a problem in 'human-resource strategy.'

E3310.0860 Hoselitz, Bert F. "Quelques Reflexions sur l'Economie de l'Education dans les Pays Sous-developpes," *Tiers-Monde,* Tome 1, Nos. 1-2, (janvier-juin 1960), 68-78.

Remarks on the relevance of the different levels of education to economic development.

E3310.0900 Kandel, I.L. "Comparative Education and Underdeveloped Countries: A New Dimension," *Comparative Education Review* Vol. 4, No. 3 (February 1961), 130-35.

The author briefly indicates the imaginative approach to the content of educational planning which must be made if the resulting educational system is to be of most use to economic development.

E3310.1000 Malassis, L. *Rapport Preliminaire Sur la Programmation Des Investissements Intellectuels en Agriculture en Relation Avec le Developpement Economique et Social et la Programmation de l'Education en General.* Paris, UNESCO, 4 septembre 1963.

The paper is intended to underline the principle that rural development goes hand in hand with the development of rural education, and hence planning of these developments must also be closely related. It goes on to consider the process of planning rural education.

E3310.1100 Myint, H. "Education and Economic Development," *Social and Economic Studies,* (March 1965), 8-21.

An incisive essay on educational strategies in underdeveloped countries. (M. Blaug)

E3310.1400 Peshkin, A. "Education in the Developing Nations: Dimensions of Change," *Comparative Education Review,* (February 1966), 53-66.

A general discussion of the role of education in promoting social and economic development, with a review of recent research. (M. Blaug)

E3310.1440 Phillips, H.M. "Economic and Social Aspects of the Planning of Education," *International Social Science Journal,* Vol. XIV, No. 4 (1962), 706-719.

A general but thorough discussion geared to underdeveloped countries. (M. Blaug)

E3310.1500 Rado, E.R. "Manpower, Education, and Economic Growth," *Journal of the Manchester Statistical Society,* Vol. IV, No. 1 (1966), 83-94.

An expert discussion of current thinking about educational planning in low-income countries in the guise of a review of earlier articles. (M. Blaug)

E3310.1800 Tinbergen, J. and Bos, H.C., "A Planning Model of Education Requirements of Economic Development," *The Residual Factor and Economic Growth,* ed. J. Vaizey. Paris, Organization for Economic Cooperation and Development, 1964.

An extension of the Tinbergen-Correa model involving more complicated basic equations, including additional labor-demand equation, and wastage equations. Three OECD Human Resource Development Fellows applied the model to Greece, Spain, Turkey, showing that the relevant coefficients differed widely. T. Balogh delivered a damning condemnation of this type of work. A.K. Sen offered a constructive critique, pointing out the analogies in the Tinbergen-Bos model to a capital-requirements model, while G. Bombach commented in general terms on the Tinbergen paper. (M. Blaug)

E3310.1840 Tiryakian, Edward A. "Quelques Aspects Negatifs de l'Education de Masse dans les Pays Sous-developpes," *Tiers-Monde,* Tome 1, Nos. 1-2 (janvier-juin 1960), 161-73.

Makes the point that a simple transference of universal education to underdeveloped societies may not produce the desired economic effects, given the particular outlook of people in these societies towards education–the channel to an elite job.

E3310.2000 United Nations Educational, Scientific and Cultural Organization. *Economic and Social*

Aspects of Educational Planning. Paris, UNESCO, 1964.

To aid countries in setting educational targets and in the complex task of relating these to their plans for economic and social development three regional conferences, in Africa, Latin America and Asia respectively, were organized by UNESCO. These conferences brought together educators and financial authorities and set realistic targets which took into account both educational and economic development needs, thus breaking new ground in the history of international cooperation. These conferences and the conclusions and action flowing from them, and the sending out of advisory missions, as well as the establishment of regional institutes to promote the spread of knowledge in this field, led to the demand for the present publication. Many of the problems dealt with are in their initial stage of analysis, and material such as that in the present work is bound to be revised from time to time as research in this new and important field goes forward. There is already, however, a pressing need to bring together what is already known on this subject. It is not yet possible to obtain a consensus as to the best methods of approach. For this reason we have attempted to produce an 'integrated manual' but offer the reader a description of the principal different approaches which are being, or could be, used in a variety of countries. (Author)

E3310.2100 United Nations Educational, Scientific and Cultural Organization. *Regional Technical Assistance Seminar on Investment in Education. Bangkok, April 6-13, 1964.* Paris, UNESCO, 1965.

In addition to the proceedings and conclusions of the Seminar, this report includes seventeen country papers on the economic and financial difficulties of implementing the Karachi Plan, as well as a number of essays by international consultants emphasizing the problem of raising additional revenue to finance investment in education. B. Higgins, the rapporteur of the seminar, contributes an excellent paper on 'Financing Investment in Education', touching on the physical and monetary bottlenecks to educational expansion, the advisability of calculating rates of return to investment in education, new sources of domestic finance, and the role of foreign aid. M. Debeauvais writes on the 'Determination of Objectives in the Regional Planning of Education', furnishing new estimates of the costs of implementing the Karachi Plan, based on improved educational statistics for 1960/1961. F. Edding furnishes what is, in fact, a brilliant short manual on the techniques of cost analysis and cost planning, illustrated by Irish, British and German data, under the title 'Problems of Expanding Investment in Education'. 'Problems of Expanding Education, With Special Reference to the Process of Revenue Raising, Centrally and Locally, For Educational Purposes, are discussed by Mrs. U. Hicks. G. Tobias analyses the implications of the acceptance by the IBRD since 1962 of the propriety of extending long-term credits to low-income countries for educational expansion: 'Problems in International Financing of Education'.

IMPROVING EDUCATION

The Program

E4100.0200 Baltimore, Maryland, Department of Education. *Citizens School Advisory Committee Abridgement of Studies and Recommendations to the Board of School Commissioners of the Baltimore City Schools.* Baltimore, Maryland, 1964.

The committee's task was to recommend improvements in the public schools in the decade ahead. It therefore, focused attention on needs, all the while appreciative of the progress that has been made over the years. The Steering Committee developed a policy approved by the General Committee granting to chairmen of the five city-wide study committees full authority and independence in the operation and the conduct of studies. The chairmen set priorities, organized subcommittees and special committees, and selected phases and areas of the school system for study. The committee has endeavored to cite promising educational and operational practices that should be continued and strengthened and has noted such practices throughout the report in recommendations or in explanations and substantiations. The committee has included a special chapter on financing of the Baltimore City Public School System. This section of the report is included for a number of purposes, foremost among which is to document the continuing efforts of the Board of School Commissioners to obtain what it believes to be sufficient funds. Many of the recommendations would be far less urgent had the budget requests been adequately supported by the Board of Estimates and the City Council. The committee believes that the Board of School Commissioners has, during recent years, submitted annual budget requests based on minimum needs of the school system, thus, any cuts in the requested budget must be viewed as causing the Board to operate the schools at a standard below minimum requirements for public education in Baltimore City. The committee has declared which recommendations it considers of highest priority and of greatest urgency. Some recommendations, therefore, call for immediate adoption and implementation, while others are submitted as goals for the decade ahead. (Author)

E4100.0240 Bantock, G.H. *Education in an Industrial Society.* London, Faber & Faber, 1963.

A solid but verbose rationalization of the conservative elitist view of education with suggestions for a suitable curriculum tailored to the needs of the 'intellectually inferior' majority (the author's phrase). See, in particular, pp. 86-87, protesting against such phraseology as 'education as an investment' or even 'education as a social service'. (M. Blaug)

E4100.0260 Barnett, Kathryn D. and Van Bibber, Lena C. *Housing, City Planning, and Our Schools for Elementary School Grades.* Baltimore, Maryland, Citizens Planning and Housing Association, 1962.

E4100.0290 Batten, T.R. *School and Community in the Tropics.* London, Oxford University Press, 1959.

A study, using examples from many countries, of schools in relation to local needs–the community approach to education, which relates it to development.

E4100.0300 Beeby, C.E. *The Quality of Education in Developing Countries.* Cambridge, Massachusetts, Harvard University Press, 1966.

This important book emphasizes the lack of education and training of teachers as the principal bottleneck for educational development in low-income countries. Chapter 4, the core of the book, sketches a stage-theory of educational development in terms of the characteristics of teachers found at various phases of educational development. Chapter 2, entitled 'Economists and Educators', discusses the biases that economists and educators respectively bring to educational planning. (M. Blaug)

E4100.0340 Boesch, Ernest E. *Adapting Education to Society.* Paris, United Nations Educational, Scientific and Cultural Organization, 14 June 1963.

Using the methodology of information theory, the author treats education as a process of transmitting information and makes suggestions accordingly for the optimization of education and educational planning in relation to the inducement of social change.

E4100.0400 Cartter, A.M. *An Assessment of Quality in Graduate Education: A Comparative Study of Graduate Departments in 29 Academic Disciplines.* Washington, D.C., American Council on Education, 1966.

An attempt to rank 106 American Graduate departments in 29 different subject fields on the basis of personal ratings by 4,000 scholars. The rankings are compared with three earlier studies of graduate schools. (M. Blaug)

E4100.0440 Committee for Economic Development. "Changing Directions in American Education," *Saturday Review,* (January 14, 1967).

Proceedings of November 1966 trustee meeting.

E4100.0460 Correa, H. "Planning Educational Curriculum," *Kyklos,* Vol. XVIII, Fasc. 4, (1965), 685-693.

This paper presents the problem of selecting the best educational curriculum as a quadratic programming problem and then shows how to transform such a problem into an integral linear programming problem. (M. Blaug)

E4100.0480 Cotgrove, S.F. *Technical Education and Social Change.* London, George Allen & Unwin, 1958.

A readable account of technical education in England and Wales, placed in a historical setting. Deals with recruitment of students, the curriculum of technical schools, the demand for technicians and technologists, reviews changing policies in technical education, and concludes with some practical recommendations. (M. Blaug)

E4100.0500 Debeauvais, Michel. *The Balance Between the Different Levels of Education.* Paris, Institut d'Etude du Developpement Economique et Social, 1963.

The paper discusses problems of measurement of educational enrollments, of construction of the educational pyramid, and of educational wastage, and then considers criteria for selecting a balance between different levels of education.

E4100.0520 Debeauvais, M. "The Balance Between Different Levels of Education," *International Economic Association Conference on the Economics of Education.* London, Macmillan, 1965.

An important contribution to a planning model of educational pyramids, chiefly with reference to underdeveloped countries. (M. Blaug)

E4100.0540 Desroche, H. "Sous-developpement et Sous-enseighement. Notes sur Quelques Colloques Recents," *Archives Internationales de Sociologie de la Cooperation,* No. 7 (janvier-juin 1960), 5-34.

The article draws on the proceedings of a number of conferences held during 1959 to establish a parallel between problems of education in both developed and underdeveloped countries, and suggests that in both cases the school can no longer be the sole channel of education. The consequences of this for educational planning require consideration.

E4100.0560 Downey, Lawrence William. *The Task of Public Education.* Chicago, Ill., Midwest Administration Center, University of Chicago, 1960.

E4100.0580 Dumont, R. "Le Developpement Agricole, Specialement Tropical, Exige un Enseignement Totalement Repense," *Tiers-Monde. Problemes des Pays Sous-Developpes.* (janvier-mars 1964), 13-39. Reprinted in English translation in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey. Paris, UNESCO, 1964.

A strong plea for a rurally biased curriculum associated with school-farms in underdeveloped countries, in imitation of what the author takes to be the Soviet example. (M. Blaug)

E4100.0600 Dyer, Henry S. "The Pennsylvania Plan." Educational Testing Service, Princeton, New Jersey, 1966.

E4100.0800 Henry, Nelson B. (ed.) *Community Education Principles and Practices from Worldwide Experience.* Chicago, National Society for the Study of Education, 1959.

A series of essays detailing experiences of community education around the world, which are used as the basis for a set of principles for its future successful practice.

E4100.0820 Hill, F.F., Adams, Don and Brittain, Roger. "Education: The Need for Constructive Ideas," *International Development Review,* Vol. IV, No. 4 (December 1962), 4-12.

A realistic appraisal of the influence which imaginative educational expansion can potentially have on the development process. The last section outlines an educational structure adapted to existing resource shortages and making use of modern methods.

E4100.1800 Orlans, H. *The Effects of Federal Programs on Higher Education. A Study of 36 Universities and Colleges.* Washington, D.C., The Brookings Institution, 1962.

An attempt to evaluate the educational and administrative impact of Title X of the National Defense Education Act of 1958 upon selected departments of 36 American universities and colleges. A convenient quick summary of the principal conclusions is found on pp. 293-294. (M. Blaug)

E4100.1900 Platt, W.J. *Toward Strategies of Education.* Menlo Park, Calif., International Industrial Development Center, Stanford Research Institute. 1961.

A general and rather unsystematic discussion of educational strategy in underdeveloped countries with some interesting graphic devices for illustrating different types of policies (pp. 17-23). (M. Blaug)

E4100.2000 Sanders, D.P. *A Preliminary Working Paper on Improving the Content of Educational Programmes.* Paris, OECD, 6 December 1963.

The paper is concerned with the qualitative aspect of educational planning, particularly in relation to labour force performance. Using a comparative approach to examine the content of education, it suggests that from this optimal educational profiles for particular occupations may be worked out, an evaluation of the relevance of the education for development may be made, and useful data for educational forecasting will be provided.

E4100.2040 Scholten, F. *The Quantitative Efficiency of the Educational System.* Paris, OECD, 9 December 1963.

The paper discusses methods of measuring the quantitative efficiency of an educational system, pointing out some of the difficulties involved, and points out the usefulness of this knowledge for educational costing and the planning of expansion of the system to meet manpower needs.

E4100.2100 Thomas, J. Alan. "Efficiency in Education: A Study of the Relationship between Selected Inputs and Test Scores in a Sample of Senior High Schools." Dissertation, Stanford School of Education, n.d.

E4100.2150 Thorp, W.L., "101 Questions for Investigation", *Economics of Higher Education,* ed. S.J. Mushkin. Washington, D.C., Government Printing Office, 1962, p. 345-357.

Six topics make up 101 questions which, the author feels, cover the subject of the economics of higher education. A compendium of research topics. (M. Blaug)

Techniques

E4200.0100 Arthur D. Little, Inc. *The Carnegie Commission on Educational Television: Cost Estimates.* New York, n.d.

For the Carnegie Commission on Education, ADL estimated the capital and operating cost required for the public programming of a national interconnected educational television system consisting of 380 stations broadcasting over transmitters located so as to be capable of reaching approximately 94% of the population of the United States. The system was based on their assumptions, but we worked closely with them in the development and refinement of both the assumptions and the related cost estimates.

In carrying out the assignment we determined the number and location of stations in the system by applying criteria selected by the Commission from alternatives developed in the course of our work. We developed estimates of the capital and operating costs for five prototype stations, and estimated costs for regional and local as well as national programming, and for electronic interconnections. (Author)

E4200.0120 Arthur D. Little, Inc. *A Foreign Manufacturer of Electrical Equipment: Market for Computer Terminals.* New York, n.d.

A foreign manufacturer of electrical equipment recognized the advent of time-shared computer systems, with remote on-line natural-language terminal devices, as an important potential hardware opportunity which might fit with their skills as a manufacturer of typewriters, accounting machines, and teleprinters, and utilize the knowledge gained in their previous computer activities in Europe. ADL studied the educational field as one of the prime long-term potential markets for terminal devices, to the extent that computer-aided instruction (CAI) achieves the expectations of some exponents. Although the profile of the education market for data terminals was only part of this study for our client of the prospects for on-line systems, this study is one pioneering effort to assess the general dimensions of CAI acceptance and to appraise its business potential. (Author)

E4200.0140 Arthur D. Little, Inc. *A Large Electronics Firm: Diversification.* New York, n.d.

ADL is assisting a large electronics firm in the establishment of a new division created to develop the market for manipulative instructional media for elementary education. (Author)

E4200.0160 Arthur D. Little, Inc. *A Leading Manufacturer of Language Laboratories: Marketing Strategy.* New York, n.d.

ADL's study for a leading manufacturer of language laboratories involved describing the present market and potential ten years hence for language laboratories of all types for all uses, with major emphasis on education. We described buying patterns characteristic of each market, present and future gross sales and types and configurations of language laboratory apparatus required by market segment. Also we characterized the type of firms in terms of size, structure and organization who have so far been successful in selling to particular market segments.

We compared the major technical features of our client's product line with those of competitors. Along with this, we noted characteristics of our client's dealer organization, sales policy, etc. This combined with the market data developed enabled us to suggest strategies to client management for more effective and profitable market penetration. (Author)

E4200.0180 Arthur D. Little, Inc. *A Major Company: Acquisition Plans.* New York, n.d.

We have helped a major company formulate an acquisition program to expand its position in education markets, and have investigated several companies in education and related markets for possible acquisition by our client. For example, we assessed the attractiveness as an acquisition candidate of a manufacturer of headsets for educational and other individual listening applications, and of mobile educational facilities. As an example of companies studied with products possibly related to the education market, we considered the educational ramifications of a manufacturer of hobby equipment to see whether this area would be a natural complement to our client's new Education Division. (Author)

E4200.0200 Arthur D. Little, Inc. *A Major Communications Company: Basic Business Strategy.* New York, n.d.

The purpose of a recent ADL study for a major diversified company was twofold:

To make an initial analysis of the education market in terms suitable to especially judging where the most attractive business opportunities might lie, and how the company might exercise a broader role in the educational field.

To recommend a strategy which will help guide future programs in education, and develop a specific guide to the areas and companies which

should be considered as acquisition possibilities.

More specifically, we sought answers to such questions as: How can the 'education market' best be structured? What are the principal characteristics of major market segments which influence their attractiveness as business opportunities, and what is their relative magnitude in terms of market size and growth? What are the major product groupings now being sold in the principal market segments, and how do they differ with respect to size, growth, and the character of the business which they represent? Considering the character of individual market segments, and also the channels by which such products are moved into educational markets, what strategy might our client adopt which would permit them to exploit business opportunities in the light of competitive realities and the risks involved? (Author)

E4200.0220 Arthur D. Little, Inc. *The National Science Foundation: Feasibility of Centralized Library.* New York, n.d.

A study was conducted for the National Science Foundation to determine the desirable degree of centralization of facilities for the storage and dissemination of scientific documents. In conducting this study, we examined the effectiveness of most existing large-scale retrieval systems and the underlying rationale of information description for subsequent recall. Specifically, we emphasized the development of mathematical models related to the effectiveness of coordinate indexing and document searching procedures; and study of associate methods of document retrieval, methods which show evidence of overcoming some of the shortcomings of existing coordinate searching systems.

We concluded that existing information handling techniques are not sufficiently advanced for effective use on a large scale. In addition, we formulated the underlying reasons for the ineffectiveness of large systems for handling documentary information. The investigation has necessarily been conducted in considerable depth in order to obtain these results. (Author)

E4200.0240 Arthur D. Little, Inc. *Service to Management: Electronics in Education.* New York, n.d.

Quite recently investors and private enterprise have exhibited great interest in the growing education market. Therefore, as part of ADL's ongoing Service to Investors and Management Programs, we investigated the education market for electronic or electro-optical equipment and related software. This equipment is characterized by high engineering or technical content and includes such items as language labs, closed-circuit TV, projectors and multimedia systems. Since the total education market is vast and complex, only the formal education systems, i.e., elementary and secondary schools and college markets, were examined.

Considering the equipment only from an instructional use standpoint, we were able to bring into objective focus some of the underlying factors governing the market and place in perspective the role and potential of instructional technology as a market for such devices. A deterrent to the wide acceptance of truly new instructional equipment is the lack of an established base of knowledge of the learning process from which definitive performance requirements and specifications can be developed. The real promise of the market lies 10-15 years hence, the target where the major new entrants have set their sights. (Author)

E4200.0260 Arthur D. Little, Inc. *U.S. Office of Education: Forces Affecting Education Innovation.* New York, n.d.

ADL has received an assignment from the U.S. Office of Education to investigate the dynamics of acceptance by school systems of educational innovations. This study will explore the communications patterns, the influence processes, and the plans and evaluations which appear to affect the way in which selected educational innovations are adopted and utilized by a sample of K-12 school systems in the United States. (Author)

E4200.0300 Benson, C.S. "Teaching Methods and Their Costs. Productivity of Present Educational Systems," *International Social Science Journal,* Vol. XIV. No. 4, (1962), 676-684.

Observations on factor costs in schools and returns from education, mainly with reference to the U.S.A. (M. Blaug)

E4200.0320 Bereday, George Z.F. and Lauwerys, Joseph A. (Editors). *The Yearbook of Education 1960. – Communication Media and the School.* London, Evans Brothers, 1960.

A compendium of essays discussing the use of mass media in schools, and including case studies of particular experiments in a number of countries.

E4200.0360 Bruner, Jerome S., "Some Theorems on Instruction Illustrated with Reference to Mathematics," *Theories of Learning and Instruction, Part I, 63rd Yearbook of the National Society of Education.* Chicago, Illinois, University of Chicago Press, 1964, p. 307.

E4200.0380 Burns, John L. *Efficiency and Innovation in Education.* New York, Committee for Economic Development, 1966.

Work on this statement has been stimulated by the belief that educational activities are carried on inefficiently, with inadequate development of new methods and slow adoption of new methods once they have been developed. The study is intended to find out whether these criticisms of the educational process are justified and, if so, how the faults they pinpoint can be corrected.

E4200.0400 Clinchy, Evans. "The New Education," *International Development Review,* Vol. IV, No. 3 (September 1962), 9-15.

A survey of recent developments in curricula, programmed learning, learning theory, teaching techniques, and the classroom environments. There remains the question of the relevance of these developments to developing countries, when their cost in comparison with traditional methods is taken into account.

E4200.0440 Coombs, P.H. *The Technical Frontiers of Education.* Los Angeles, California, University of California, 1960.

The author discusses the barriers to rapid technical change in the methods of education, and the increasing need to overcome them, and points out some ways in which innovation may take place.

E4200.0500 Dlugatch, Irving. *A Low Cost Communication Satellite Educational System.* System Development Corporation, Santa Monica, California, August 1966. (DDC No. AD-640 649).

Television and a space vehicle are combined for an educational system and a cost-effectiveness analysis is

performed. The proposed system is characterized by the simplicity and low cost of the equipment involved.

E4200.0550 Dottrens, Robert. *The Primary School Curriculum.* Paris, UNESCO, 1962.

For the national educational planner, this is education viewed through the opposite end of the telescope–the pedagogical approach to increased efficiency in the classroom, which is important for the effectiveness of educational planning, and hence significant for the planner.

E4200.1000 *University of Hawaii. Recommendations and Plans for New Media Programs in Hawaii.* 1965.

A collection of working papers composed by members of the Media Specialist Institute, University of Hawaii Communications Center, June 21 - July 31, 1965. Mimeographed.

E4200.1100 International Cooperation Administration. *Conference on the Application of Newer Scientific Methods of Learning and Teaching to Selected Major Educational Problems in Developing Countries.* Washington, D.C., ICA, 1961.

The report summarizes the proceedings of the conference, in which the application of newer educational techniques to six educational problems was discussed.

E4200.1200 The International Institute for Educational Planning. *New Educational Media in Action: Case Studies for Planners, Volume I.* Paris, IIEP, April 1967.

E4200.1220 The International Institute for Educational Planning. *New Educational Media in Action: Case Studies for Planners, Volume II.* Paris, IIEP, April 1967.

E4200.1240 The International Institute for Educational Planning. *New Educational Media in Action: Case Studies for Planners, Volume III.* Paris, IIEP, May 1967.

E4200.2000 Maryland. State Department of Education. *Educational Programming in Simulated Environments for Seriously Emotionally Handicapped Elementary Children.* Baltimore, Maryland State Department of Education, 1964-1966.

E4200.2400 Organization for European Economic Cooperation. *Television for School Science.* Paris, OECD, 1960.

Seminar reviewing the progress and possibilities of television as a teaching medium, in particular in relation to science teaching in Europe.

E4200.2800 Renshaw, E.F. "Will the American Educational System Ever Be Efficient?" *School Review,* (Spring 1958), 70-79.

A plea for mechanical teachers' aids to overcome the resistance of educationalists to larger student-staff ratios. (M. Blaug)

E4200.2900 Schramm, Wilbur. *Programmed Instruction Today and Tomorrow.* New York, The Fund for the Advancement of Education, 1962.

Brief description of American efforts in the development of programmed learning, whether through machines or textbooks, and discussion of its use in developing countries, and its future potential.

E4200.2920 Schramm, Wilbur, Coombs, P.H., Kahnert, F. and Lyle, J., *The New Media: Memo to Educational Planners,* The International Institute for Educational Planning, Paris, n.d.

(Also to be published in Spanish in May 1967 and French in June 1967.)

E4200.2960 Smith, Robert G., *The Design of Instructional Systems.* Technical Report, George Washington University, Human Resources Research Office, Alexandria, Virginia, November 1966. (DDC No. AD-644 054).

The report, based on an extensive survey of current literature, describes and discusses a system approach to designing training and considers factors bearing on training effectiveness. An efficient instructional system is conceived as one in which the components form an integrated whole, achieving maximum effectiveness at the least possible cost. Components considered in this report include presentation media, student management, techniques for practicing knowledge and performance, knowledge of results, directing student activities toward the goals of the training program, and testing and evaluating the system in terms of efficiency and cost.

E4200.3500 United Nations Educational, Scientific and Cultural Organization. *Developments in Audio-Visual Education.* Paris, UNESCO, 1963.

A group of articles on experiences of using television and programmed learning techniques in education.

E4200.3540 United Nations Educational, Scientific and Cultural Organization. *New Methods and Techniques in Education.* Paris, UNESCO, 1963.

A series of articles reviewing various new educational methods and techniques. The introductory chapter by Wilbur Schramm poses some of the planning problems of utilizing these media in developing countries desiring rapid educational expansion.

E4200.4000 Williams, Gareth, "Some Proposals for an Investigation into the Economics of Teaching Methods," *Planning Education for Economic and Social Development.* Paris, OECD, 1963, p. 261-65.

Suggestions are made as to the role of the economist in evaluating new educational techniques, e.g. by comparing their cost to those of more traditional methods.

Vocational Education

E4300.0100 Arthur D. Little, Inc. *California State Board of Education: Vocational Education.* New York, n.d.

In December 1966, ADL was selected to devise for California a well-coordinated and effective vocational education program plan capable of both meeting fully the requirements of the state's economy and of assuring more

completely the welfare of its residents.

The study has as its main purposes: (1) a review of the present status of vocational education in California, (2) a projection of future needs for and in vocational education, (3) an evaluation of the manner in which the existing program is meeting current needs, and (4) recommendations for future program development.

It is anticipated that the plan will, in addition to charting the course of the State Board of Education and the State Department of Education, also include guidelines for vocational education policies and procedures in local districts. (Author's abstract)

Many points of focus will be involved in pursuing each of the four main purposes. Among the most significant of these are the students, teachers, curricula, counseling and guidance programs, educational facilities, financing, instruction outside of public schools, and jobs California offers, support and cooperation of employers and employees, and liaison and leadership afforded by local, state, and federal agencies.

Primary emphasis will be placed on the public high schools, adult and continuation schools, and junior colleges. However, the roles and responsibilities of the four-year colleges and universities on the one hand, and the elementary and junior high schools on the other–insofar as proper articulation is concerned–will also be considered. (Author)

E4300.0200 Bowman, M.J. "The Land-Grant Colleges and Universities in Human-Resource Development," *Journal of Economic History*, (December 1962), 523-546, Reprinted in *Readings on Education and Economic Development*, eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

An analysis of the contribution made by land-grant colleges, with their heavy bias towards vocational education, to American economic growth in the nineteenth century. (M. Blaug)

E4300.0300 Clark, Harold F. "La Educacion y el Desarrollo Economico," *La Educacion*, Ano V, No. 17 (eneromarzo 1960), 17-23.

This article makes out the case for an increase in vocational education during the period of development, adapted, particularly in the agricultural sector, to local needs. The problem of how far this type of educational expansion can be concentrated in the schools is also touched upon.

E4300.0350 Corazzini, A.J. and Bartell, E. "Problems of Programming an Optimum Choice Between General and Vocational Education," *Kyklos*, Vol. XVIII, No. 4 (1965), 700-704.

Extremely critical comments on Correa's paper of that title. (M. Blaug)

E4300.0370 Correa, H. "Optimum Choice Between General and Vocational Education," *Kyklos*, Vol. XVIII, 1965.

E4300.2000 Marshall, A. *The Principles of Economics*. London, Macmillan, 9th ed., 1961, Bk. IV, Ch. 6. pp. 204-219; Bk. VI, Ch. 4, pp. 563-566, Mathematical Note XXIV, p. 858. Reprinted in *Readings in Education and Economic Development*, eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

Marshall's discussion in the 1890's of industrial training in which he shows how education might be treated as a national investment. (M. Blaug)

E4300.2200 Page, Andre. *Desirable Balance Between General Education and Technical and Vocational Training*. Paper given at the International Economic Association Conference on the Economics of Education, Menthon St. Bernard, 29 August - 7 September 1963.

The paper is useful in outlining the social and economic obstacles to an expansion of technical education in developing societies.

E4300.2400 Rivlin, A.M., "Critical Issues in the Development of Vocational Education," *Unemployment in a Prosperous Economy*, eds. W.G. Bowen, F.H. Harbison. Princeton, N.J., Princeton University, 1965, p. 153-67.

A general discussion of present knowledge about the three main questions to be answered about training: (a) how much training should the labor force have? (b) where should training for work occur? (c) who should pay the cost? (M. Blaug)

Retraining

E4400.0300 Conley, Ronald W. *The Economics of Vocational Rehabilitation*. Baltimore, Maryland, Johns Hopkins Press, 1965.

Investigates selected aspects of the economic problems caused by physical and mental disability and of the economic benefits of vocational rehabilitation.

E4400.0500 Hawaii. Department of Personnel Services, Administrative Division. *Employment of Handicapped Persons*. March 18, 1965.

E4400.2000 Mincer, J. "On the Job Training: Costs, Returns and Some Implications," *Journal of Political Economy*, Supplement, (October, 1962) 50-80. Excerpts reprinted in *Readings on Education and Economic Development*, eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey. Paris, UNESCO, 1964.

Estimates the amounts of resources invested in on-the-job training in the U.S.A. and the rates of return on such investment, and discusses some of the implications of the findings. (M. Blaug)

E4400.2040 Moore, Michael M. "Cost-Benefit Analysis: Retraining the Poor." Unpublished, 1965.

The cost-benefit trade-off involved in a massive training program is investigated. The program would be aimed at heads of families with annual incomes of under $3000 and would consist of a literacy program followed by vocational instruction. Sensitivity analysis is performed on all important assumptions, including the definitions of the major "benefits".

E4400.2200 Organization for Economic Cooperation and Development. *Accelerated Vocational*

Training for Unskilled and Semi-Skilled Manpower. Paris, OECD, October 1960.

E4400.2250 Organization for Economic Cooperation and Development. *Job Redesign and Occupational Training for Older Workers.* International Management Seminar, London, 30 September - 2 October 1964. Final Report. Paris, OECD, July 1965.

E4400.2300 Richardson, J.C. Peter. "A Proposal to Break the Communications Barrier," *International Development Review,* Vol. IV, No. 3 (September 1962), p. 32-35.

The article discusses a method developed for rapidly teaching a limited English reading ability to extend the accessibility of simple technical literature. It makes some tentative cost estimates, and advocates further more detailed study of the whole idea.

E4400.2400 Ross, Arthur M. (ed.). *Employment Policy and the Labor Market.* Papers presented at the Research Conference on Unemployment at Boulder, Colorado, June 1964. Berkeley, California, University of California Press, 1965.

"Retraining: An Evaluation of Gains and Costs," by Gerald G. Somers, pp. 271-298.

E4400.2600 Somers, Gerald S., "Retraining: An Evaluation of Gains and Costs," *Employment Policy and the Labor Market,* ed. by Arthur M. Ross. Berkeley, California, University of California Press, 1965, p. 271-298.

The analysis presented here points in directions which are favorable for government-sponsored training of the unemployed. The economic gains of the trainees–and perhaps of society–derived from the retraining would seem to outweigh the economic costs. If social-psychological benefits accruing from an unemployed worker's return to the active labor market are added, the scales are heavily weighted on the positive side. (Author)

E4400.2640 Somers, G.S. and Stromsdorfer, E.W. "A Benefit-Cost Analysis of Manpower Retraining," *Proceedings of the Seventeenth Annual Meeting of the Industrial Research Association.* Reprinted as Social Systems Research Institute Report No. 99, Madison, Wisconsin, The University of Wisconsin, 1965.

An analysis of the findings of a survey of trainees and non-trainees in Western Virginia, relating the gains in employment and earnings to the costs of the retraining programme. This is a preliminary version of a forthcoming book to be edited by G.S. Somers: *Retraining of the Unemployed: Case Studies of the Current Experience.* (M. Blaug)

E4400.3000 Venables, P.F.R. and Williams, W.J. *The Smaller Firm and Technical Education.* London, Mas Parrish, 1961.

Gives results of an enquiry among small firms in building and engineering industries to estimate the extent of education and training programmes in firms and discusses the costs of training in such firms. See particularly, ch. 3: 'Manpower and Educational Requirements', pp. 45-70. (M. Blaug)

COSTS AND BENEFITS

E5000.0100 Stone, R. "Input-Output and Demographic Accounting: A Tool for Educational Planning," *Minerva,* (Spring 1966), 365-381.

Financing

E5100.0200 Bailey, S.K., Frost, R.T., Marsh, P.E. and Wood, R.C. *Schoolmen and Politics. A Study of State Aid to Education in the Northeast.* The Economics and Politics of Public Education, No. 1. Syracuse, N.Y., Syracuse University Press, 1962.

A study by four political scientists of the political forces influencing state aid to education in the northeastern part of the United States. Argues the case that government aid to public schools can only be understood as the outcome of conflicting political forces. (M. Blaug)

E5100.0220 Benson, C.S. *The Cheerful Prospect: A Statement on the Future of American Education.* Boston, Mass., Houghton Mifflin, 1965.

A discussion of financial and administrative issues in American education, with frequent references to the British system. The author suggests a number of reforms, such as reorganization of school districts and the establishment of state salary scales for teachers, which he argues would increase equality of educational provision and efficiency of resource allocation. (M. Blaug)

E5100.0240 Benson, C.S. *The Economics of Public Education.* New York, Houghton Mifflin Co., 1961.

This trail-blazing textbook goes beyond the usual treatment of school finance as a branch of school administration, and attempts explicit use of economic reasoning in analyzing school expenditures. No prior knowledge of economics is assumed and virtually every aspect of American education is covered: problems of federal, state and local finance; the case for public education; the problem of efficiency in education; trends in teachers' salaries; and the impact of inflation on educational spending. (M. Blaug)

E5100.0260 Bloomberg, W., Jr. and Sunshine, M. *Suburban Power Structures and Public Education. A Study of Values, Influence and Tax Effort.* The Economics and Politics of Public Education, No. 10. Syracuse, N.Y., Syracuse University Press, 1963.

Two sociologists construct and test a socio-political model of the determinants of local taxation to support public education. A bibliographical appendix of relevant literature is included. (M. Blaug)

E5100.0280 Burke, A.J. *Financing Public Schools in the United States.* New York, Harper & Bros., 2nd ed., 1957.

A textbook for school administrators providing a background for determining policy in the financing of public schools. (M. Blaug)

E5100.0300 Burkhead, J. *State and Local Taxes for Public Education.* The Economics and

Politics of Public Education, No. 7. Syracuse, New York, Syracuse University Press, 1963.

An expert appraisal of the adequacy of American state and local taxes for the support of elementary and secondary education, with particular attention to the property tax, its character, burden, economic effects, income-elasticity, and administrative patterns. The first chapter of the monograph discusses the possibility of a general theory of intergovernmental finance. (M. Blaug)

E5100.0400 Carovano, J.M. "Financing Public Higher Education, 1969-1970," *National Tax Journal,* (June 1966), 125-138.

Enrollment in American schools in 1969 is calculated on the assumption that enrollment in private institutions in each state will increase at the same rate in the 1960's as in the 1950's, and the required income per student is projected on this basis. Staff salaries are projected on the assumption of unchanged student/staff ratios and again on the assumption of a one per cent increase in student/staff ratios with no fall in quality. (M. Blaug)

E5100.0420 Cartter, A.M. "Tax Reliefs and the Burden of College Costs," *The Educational Record,* (October 1963), 424-432.

A discussion of the many bills now before Congress to grant tax credits to parents with children attending college, an arrangement which, the author argues, would really only benefit high-income families. (M. Blaug)

E5100.0460 Committee for Economic Development. *Paying for Better Public Schools.* New York, Committee for Economic Development, 1959. Excerpts reprinted in *Perspectives on the Economics of Education. Readings in School Finance and Management,* ed. C.S. Benson. Boston, Houghton Mifflin, 1963, p. 273-285.

This excellent pamphlet on ways of financing projected expansion of elementary and secondary schools through the 1960's includes valuable historical and current data on expenditures, incomes and enrollment by states. Ch. 3 on 'The Role of the Federal Government' concludes that further extension of Federal Government activities in the field of elementary and secondary education is undesirable. A number of committee members, however, dissented from this conclusion. (M. Blaug)

E5100.0800 Friedman, M., "The Role of Government in Education," *Economics and the Public Interest,* ed. R.E. Solo. New Brunswick, N.J., Rutgers University Press, 1955, p. 123-144, revised in M. Friedman, *Capitalism and Freedom.* Chicago, Ill., University of Chicago Press, 1963, p. 85-108. Reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964; and *Perspectives on the Economics of Education. Readings in School Finance and Management,* ed. C.S. Benson. Boston, Houghton Mifflin, 1963, p. 132-143.

A plea for more private provision of education with a plan whereby the central government would furnish vouchers to parents, redeemable for a specified maximum sum per child per year in any 'approved' educational institution of their own choice. (M. Blaug)

E5100.0920 Goode, R.B. "Tax Treatment of Individual Expenditures for Education and Research," *American Economic Review,* (May 1966), 208-217.

A useful review of the current American tax treatment of educational expenditures with some specific suggestions for reform. (M. Blaug)

E5100.1000 Harris, S.E. *Higher Education: Resources and Finance.* New York, McGraw-Hill, 1962.

Covers an extremely wide range of issues and sometimes reads like a personal journal. Parts 2, 3, and 4 deal with the question of tuition levels and student aid; once an outspoken advocate of very much higher tuition fees, Harris here modifies his views and instead favors increases in scholarship aid, particularly increases in federal loan funds to be made available on a long-term basis at subsidized rates of interest. Book includes four chapters comparing expenditures for higher education, burden, capacity and effort in the fifty American states. The final section is devoted to the micro-economics of higher education-management of endowment costs and economies in institutions, and faculty salaries. The findings are summarized by the author in *Economic Aspects of Higher Education,* ed. S.E. Harris, Paris: OECD, 1964, pp.109-117. See also E.F. Renshaw's suggestive review-article of the book in *School Review,* Winter, 1963, pp. 493-503, dealing with the issue of university fees. (M. Blaug)

E5100.1020 Harris, S.E., (ed.). *Higher Education in the United States. The Economic Problems.* Cambridge, Mass., Harvard University Press, 1960.

A large number of contributors, including a few economists, address themselves to the issues of the proper level of tuition fees and government aid, costing, finance, investment of endowed funds, and the like. The article by K. Deitch, 'Some Observations on the Allocation of Resources in Higher Education,' pp. 192-199, is reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey, Paris: UNESCO, 1964. (M. Blaug)

E5100.1040 Harris, S.E. *How Shall We Pay for Education?* New York, Harper & Bros., 1948.

This book opens with the sentence: 'Economists should pay more attention to the economics of education.' It is predominantly concerned with the impact of inflation on educational expenditures. Includes historical surveys of trends in public spending on education, tuitions, endowments and salaries. (M. Blaug)

E5100.1060 Hill, Donald W., "Progress Report on Program Budgeting in Chicago," *Trends in Financing Public Education,* Committee on Educational Finance. Washington, D.C., National Education Association, 1965.

Chicago experience shows that PPBS not only leads to more rational expenditure allocation but also to improved tax-payer response to shortages in programs and their willingness to accept tax increases.

E5100.1080 International Institute of Public Finance. *Public Finance and Education.* Papers and Proceedings of the XXIst Session of the IIPF, Paris, September 1965, *Public Finance,* Vol. XXI, Nos. 1-2 (1966), 1-325.

The papers include: (1) a veritable handbook on educational finance by M. Frank, E. Rosselle, 'Finances publiques et education,' pp. 1-121; (2) M. Orlowski, Z. Pirozynski, 'Problems of Financing Education in Socialist Countries,'

with comment by J.B.D. Derksen, pp. 121-170; (3) V.V. Lawrov, 'Socialist System of Financing Public Education,' pp. 170-184; (4) M.H. Peston, 'The Theory of Spillovers and its Connection with Education,' with comments by M. O'Donoghue, pp. 184-206; (5) L. Faluvegi, 'The Planning of Budgetary Expenditure on Education on the Basis of a Mathematical Model – the Method Employed in Hungary,' with comments by A.T. Peacock, pp. 206-236; (6) C. D'Hoogh, 'Systemes de financement et optimalisation des depenses d'enseignement,' pp. 236-258; (7) E. Liefmann-Keil, 'Grants in Aid to students in a Growing Economy with Technical Progress, A Comment.' pp. 258-269; (8) S.A. Aluko, 'Public Finance and Education in Nigeria,' with comments by E.R. Rolph, pp. 269-316; and (9) a summary of the issues raised at the conference by J. Wiseman, pp. 316-325. (M. Blaug)

E5100.1200 Keezer, D.M., (ed.). *Financing Higher Education 1960-1970.* The McGraw-Hill Book Company 50th Anniversary Study of the Economics of Higher Education in the United States. New York, McGraw-Hill, 1959.

A collection of a dozen papers by various American authorities, including 'An Economist's Overview of Higher Education' by P.H. Coombs, pp. 12-35; 'Financing of Higher Education: Broad Issues' by S.E. Harris, pp. 35-79; 'The Role of Student Charges; by J.D. Millett, pp. 162-183; 'Government Support of Higher Education' pp. 183-220; 'Potentialities of Educational Establishments Outside the Conventional Structure of Higher Education' by H.F. Clark, pp. 257-274; and several articles dealing with the management and efficient operation of universities and colleges. (M. Blaug)

E5100.1400 Lansing, J.B., Lorimer, T. and Moriguchi, C. *How People Pay for College.* Ann Arbor, Mich., The University of Michigan, 1960.

This study of the costs of higher education borne by American parents is based on two special social surveys conducted by the Survey Research Center. It examines both the factors influencing the present size of parents' contributions and those influencing parents' plans to finance college education for their children. A particularly important section in ch. V, sect. B on the 'Factors Influencing Educational Attainment'. pp. 119-146. (M. Blaug)

E5100.1600 Miner, J. *Social and Economic Factors in Spending for Public Education.* The Economics and Politics of Public Education, No. 11. Syracuse, New York, Syracuse University Press, 1963.

An impressive attempt to expound the theory of public expenditures as it relates to education (Ch. 2), to review previous American empirical studies of the determinants of public expenditures on education (Ch. 3), and to present an ambitious original empirical study, based on a sample of 1,100 local school systems in 23 states. A brief concluding chapter summarizes the major findings. (M. Blaug)

E5100.1650 Mort, P.R., Reusser, W.C., and Polley. *Public School Finance. Its Background, Structure and Operation.* New York, McGraw-Hill, 3d. ed., 1960.

A good example of the approach in teaching educational finance in American teachers colleges, emphasizing the administrative and accounting aspects of finance at the expense of the economic aspects. (M. Blaug)

E5100.1690 Munger, F.J. and Fenno, R.F., Jr. *National Politics and Federal Aid to Education.* The Economics and Politics of Public Education, No. 3. Syracuse, New York, Syracuse University Press, 1962.

An important study of American education as a subject of political controversy. After a brief survey of the history of unsuccessful attempts to approve a long-term federal aid program for elementary and secondary education in the U.S.A., this book reviews issues of federal aid to education, organizations for and against federal aid, results of public opinion polls, the positions of the two major political parties, the action of various presidents, the role of the Office of Education and of House and Senate Committees on Education, concluding with an appraisal of future prospects of increasing federal educational assistance. (M. Blaug)

E5100.1694 Musgrave, R.A. *The Theory of Public Finance; A Study in Public Economy.* New York, McGraw-Hill, 1959, p. 3-27. Excerpts reprinted in *Perspectives on the Economics of Education; Readings in School Finance and Management,* ed. C.S. Benson. Boston, Houghton Mifflin, 1963, p. 96-104.

Essential background reading to questions of educational finance and the economic case for public education. Develops the distinction between private wants, social wants and merit wants, pointing out that education does not fall exclusively into either of the three categories. Emphasizes that arguments about public or private finance should not be confused with the issue of public or private provision. (M. Blaug)

E5100.1750 National Education Association. *Trends in Financing Public Education.* Proceedings of the Eighth National Conference on School Finance. Washington, D.C., NEA, 1965.

Some thirty brief non-technical articles on the broad economic and political issues in school support, the development of measures of ability of state and local government to support schools, the size-cost structure of school systems, the improvement of the property tax, and the decision-making process in school finance. Among the leading writers contributing to this volume are A.M. Rivlin, C.S. Benson, and J. Burkhead. (M. Blaug)

E5100.1820 Parrish, R.M. "The Economics of State Aid to Education," *Economic Record,* (September 1963), 292-305.

Justifies state aid in Australia to private schools on grounds of expediency, having previously argued that the government ought to encourage investment in education. (M. Blaug)

E5100.1840 Pauly, M.V. "Mixed Public and Private Financing of Education: Efficiency and Feasibility," *American Economic Review,* (March 1967), 120-130.

A terse theoretical paper, demonstrating with the aid of the distinction between marginal and inframarginal externalities that equal public support to each student violates Pareto optimality. (M. Blaug)

E5100.1860 Peacock, A.T. and Wiseman, J. *Education for Democrats.* London, Institute of Economic Affairs, 1964.

The Friedman-Wiseman proposal for the private provision but public finance of education, worked out in greater detail and with special attention to the British scene. (M. Blaug)

E5100.2000 Rivlin, A.M. *The Role of the Federal Government in Financing Higher Education.* Washington, D.C., Brookings Institution, 1961.

An outline of the history of federal programmes and the current status of federal support. Particularly interesting is Chapter 8, 'The Case for Government Subsidies to Higher Education,' which rejects the Friedman argument and discusses which levels of higher education should be most heavily subsidized. (M. Blaug)

E5100.2100 Ruml, B. *Memorandum to a College Trustee. A Report on the Financial and Structural Problems of the Liberal College.* Prepared for the Fund for the Advancement of Education. New York, McGraw-Hill, 1959.

A proposal to double academic salaries in liberal colleges in the USA by the reorganization of the curriculum and by altering existing methods of instruction. Part 3 (pp. 27-45) contains a number of illustrative arithmetical models for colleges of different sizes. Part 4 (pp. 45-77) discusses the practical problems that may arise in adopting the Ruml plan. (M. Blaug)

E5100.2400 Stimbert, E.C., "Progress Report on Programmed Budgeting in Memphis," *Trends in Financing Public Education,* Committee on Educational Finance. Washington, D.C., National Education Association, 1965.

A programming-planning-budgeting system aids Memphis in predicting its money needs with a horizon of more than five years, in reducing the costs of administration, and in gaining taxpayer acceptance for increased taxes.

E5100.2450 *Study Committee on Federal Responsibility in the Field of Education.* Submitted to the Commission on Intergovernmental Relations by the Study Committee on Federal Responsibility in the Field of Education. Washington, D.C., Government Printing Office, 1955.

A quick review of existing grant-in-aid programmes to the states and some recommendations for further federal aid. Ch. 8, pp. 43-99, and the appendix tables provide useful data on the unequal educational standards of different American states. (M. Blaug)

E5100.2500 Sufrin, S.C. *Issues in Federal Aid to Education.* The Economics and Politics of Public Education, No. 4. Syracuse, New York, Syracuse University Press, 1962.

A rapid review of the problem of taxable capacity and the difficulties in administering federal aid. The final chapter looks at the Congressional Debate over the Public School Assistance Act of 1961, illustrating the deep-seated American fear of centralization of education. (M. Blaug)

E5100.2900 United Nations Educational, Scientific and Cultural Organization. International Bureau of Education. *Financing of Education. A Comparative Study.* XVIIIth Conference on Public Education. Paris, Geneva, IBE-UNESCO, 1955.

Covering 55 countries, this survey answers such questions as financial responsibility of administration; sources of funds; main items in budgets; and present trends. Statistics of public expenditures on education in 1953 are presented for all countries. (M. Blaug)

E5100.3000 Vickrey, W., "A Proposal for Student Loans," *Economics of Higher Education,* ed. S.J. Mushkin. Washington, D.C., Government Printing Office, 1962, p. 268-281.

A proposal for encouraging students to borrow to finance their education by allowing them to repay a percentage of their future income rather than a fixed sum with interest. (M. Blaug)

E5100.3200 West, E.G. *Education and the State. A Study in Political Economy.* London, The Institute of Economic Affairs, 1965.

This is an unusually provocative and important book, combining, at one and the same time, an argument for fostering private education in modern Britain by means of a Friedman-Peacock-Wiseman voucher scheme, a sketch of a reinterpretation of the history of education in nineteenth century Britain, and a series of notes on the treatment of education by the great economists of the last 200 years. The discussion moves simultaneously on all three fronts, which makes for fascinating, if sometimes a little confusing, reading. This is a book that will delight some and infuriate others. (M. Blaug)

E5100.3220 West, E.G. "Tom Paine's Voucher Scheme for Public Education," *Southern Economic Journal,* (January 1967), 378-382.

An interesting historical note which shows that the roots of the Friedman vouch scheme go back to Paine's *Rights of Man.* (M. Blaug)

Costs

E5200.0400 Edding, Friedrich, "Estimating Costs of Educational Requirements," *Planning Education for Economic and Social Development.* Paris, Organization for European Cooperation and Development, 1963, p. 233-44.

The problems of estimating the capital and current costs of educational expansion programmes, an important step in adducing their feasibility, are discussed.

E5200.0420 Edding, F. *Methods of Analyzing Educational Outlays.* Statistical Reports and Studies. Paris, UNESCO, 1966.

A guide to cost analysis of educational expenditures on the institutional, regional and national level. (M. Blaug)

E5200.0600 Hirsch, W.Z. *Analysis of the Rising Costs of Public Education.* Study Papers No. 4. Joint Econ. Comm., Congress of the U.S. Washington, D.C., Government Printing Office, 1959, p. 1-43. Excerpts reprinted in *Perspectives on the Economics of Education. Readings in School Finance and Management,* ed. C.S. Benson. Boston, Houghton Mifflin, 1963, p. 150-162.

Test of a hypothesis that daily current expenditure for primary and secondary education is a function of high school enrollment as a proportion of total enrollment, the percentage of pupils in urban areas, the annual salaries of teachers, and the number of principals per 1,000 pupils. Teachers' salaries turned out to be the crucial variable. A succinct summary of the argument is to be found in the author's article: 'Determinants of Public Education Expenditure,' *National Tax Journal,* March 1960, pp. 29-41. (M. Blaug)

E5200.0700 United Nations Educational, Scientific and Cultural Organization. International Bureau of Education. *Expansion of School Building.* Paris/ Geneva, 1957.

Comparative study of proposals for the practice of school building in a number of countries. Also individual country reports.

E5200.0800 James, H.T., Kelly, J.A. and Garms, W.I. *Determinants of Educational Expenditures in Large Cities of the United States.* Stanford, California, Stanford University School of Education, 1966.

An attempt to explain variations in levels of educational expenditure in the 14 largest city school systems in the United States. Multiple regression analysis shows that the most important determinants of educational expenditure are socio-economic characteristics of the city population, such as average education of adults, the level of unemployment, and the per capita income of the city. Argues that this raises serious policy questions, since most large American cities are faced with increased demands for educational facilities, shrinking local revenue, and a decline in the average level of schooling in the adult population. (M. Blaug)

E5200.1000 Machlup, F. *The Production and Distribution of Knowledge in the United States.* Princeton, N.J., Princeton University Press, 1962, Chapter 4, p. 51-145.

Chapter 4 presents a detailed review of all the relevant literature on the costs of formal education in the U.S.A., together with some discussion of the rate-of-return approach. Elsewhere in this book, Machlup attempts for the first time to measure the total costs of all types of informal education in the U.S.A. (M. Blaug)

E5200.1200 Oddie, Guy. *School Building Resources and their Effective Use: Some Available Techniques and their Policy Implications.* Paris, OECD, 1966.

A highly technical examination of methods of improving the design and utilization of school buildings, sponsored by the M.R.P. (M. Blaug)

E5200.1400 Riew, J. "Economics of Scale in High School Operation," *Review of Economics and Statistics,* (August 1966) 280-288.

An econometric analysis of the relationship between school size and cost per pupil place, based on data for senior high schools in the State of Wisconsin, concluding that the schools in question do operate under conditions of increasing returns to scale. (M. Blaug)

E5200.1450 Robinson, E.A.G. and Vaizey, J.E. (eds.). *The Economics of Education.* Proceedings of a conference held by the International Economic Association, New York, St. Martin's Press, 1966.

General problems of education. Education and economic progress. Demand and supply. The cost and financing of education. Balance between different forms of education. International aid in education. Summary record of the discussions.

E5200.2000 United Nations Educational, Scientific and Cultural Organization. *World Campaign for Universal Literacy.* Paris, UNESCO, 1963.

A report of a proposed 10-year campaign to bring literacy to two-thirds of the 500 million illiterates in the member states of UNESCO at a total cost of about $2 b. The report includes a new survey of illiteracy (with replies from only 67 countries) and a fairly detailed analysis of the cost and financing of such a campaign. (M. Blaug)

E5200.2500 Vaizey, J. and Chesswas, J.D. *The Costing of Educational Plans.* The Fundamentals of Educational Planning: A Series of Training Booklets, International Institute for Educational Planning, n.d.

Vaizey, J.; Chesswas, J.D., La Planification de l'Enseignment: Evaluation des Couts, Principes de la Planification de l'Education–Manuels, Paris, The International Institute for Educational Planning, in preparation.

E5200.2600 Wasserman, W. *Education Price and Quantity Indexes.* The Economics and Politics of Public Education, No. 12. Syracuse, N.Y., Syracuse University Press, 1963.

An original contribution to the literature on measuring the product of the 'education industry,' quite technical, yet full of concrete illustrations of how to construct indices of educational inputs. The fifth chapter provides a useful review of previous work in this area, showing that even the best studies sometimes ignore changes in the quality of education over time. The appendix demonstrates the possibility of compiling an education price index by linear programming methods. (M. Blaug)

Costs – Professional Employees

E5210.0100 Arthur D. Little, Inc. *California Association of School Administrators: Staff Planning in Schools,* New York, n.d.

A study for the California Association of School Administrators set down guidelines for staffing to facilitate constructive change. The team interviewed key school officials to find how staffing plans are integrated in other long-range planning. It developed guides for ways to find optimum staffing patterns for school districts of many different types in many different contexts. The study indicated its assessment of trends in the numbers of central and school building staffs, and the division between the evaluative and support functions in staffs. The study ended with outlining a logical, systematic series of steps in a planning process which districts can use as a guide in making decisions affecting the allocation of professional staff. (Author)

E5210.0120 Arthur D. Little, Inc. *California State Department of Education: Meeting Requirements for Teachers.* New York, n.d.

For the California State Department of Education, we recently studied the supply and demand for teachers for the California public school system over the next ten years. Interviews were conducted with knowledgeable and articulate people responsible for educating and recruiting teachers. Interviews with teachers and prior research on career choice provided the background for a questionnaire to a 5 percent sample of California school teachers. This questionnaire surveyed reasons for choosing the teaching profession, occupational goals, experiences in teaching, and occupational plans. An input-output model, the inputs of which were varied to simulate possible actions by the California State Department of Education, estimated trends in the supply of teachers. Population projections supplied by the State were used as basic data in estimating the demand for teachers. (Author)

E5210.0140 Arthur D. Little, Inc. *North Haven, Connecticut, School System: Professional Staff Requirements.* New York, n.d.

For the City of North Haven, Connecticut, ADL defined their requirements over the next three years for professional staff above the classroom level, e.g. remedial reading and speech specialists, curriculum coordinator, audiovisual specialist, director of special pupil services and programs, etc. We conducted a series of interviews with representatives of all segments of the professional staff (including teachers) to determine what administrative and educational processes need to be improved, why, and in what way. We suggested priorities for implementing our specific recommendations in order to meet the most urgent needs first, and recommend an organizational configuration based on the pattern of functional and administrative services and units.

Our approach emphasized functional analyses of education, administrative and supervisory requirements in the school system based on specific and emerging needs. We reviewed and analyzed current and recent projects and programs, evaluated both formally enunciated and informally understood goals and objectives of the school system, analyzed staff ratios, appraised interaction between and among different units and functional responsibilities, and determined whether there were ambiguous or overlapping areas of responsibility. (Author)

E5210.0200 Bowman, M.J. "Educational Shortage and Excess," *Canadian Journal of Economics and Political Science,* (November 1963), 446-462.

An illuminating clarification of the various meanings of 'shortage' or 'excess' of manpower, with special attention to teacher shortage and excess. (M. Blaug)

E5210.0300 Chance, W.A. "Long-Term Labor Requirements and Output of the Educational System," *Southern Economic Journal,* (April 1966), 417-429.

This paper presents a simplified Leontief-type model linking projections of future labor requirements to the output of the educational system and illustrates the argument with a representative linear programming solution of the model. The paper closes with a few judicious self-critical comments. (M. Blaug)

E5210.0350 Committee On Utilization of College Teaching Resources: *Better Utilization of College Teaching Resources. A Summary Report.* Fund for the Advancement of Education, New York, FAE, 1959.

The findings of a programme of grants to some 60 American colleges and universities to explore methods of economizing on teachers. Among the conclusions is that the size of classes can be significantly increased without harmful effects on students through better training of teachers and the wider use of mechanical aids. (M. Blaug)

E5210.0370 Correa, H., "Quantity versus Quality in Teacher Education," *Comparative Education Review,* Vol. 8, No. 2 (October 1964).

This paper attempts to provide a mathematical model for determining the costs and benefits of producing large numbers of poorly-qualified teachers instead of small numbers of highly-qualified teachers for societies with limited resources for education. Thus it is very relevant to resource allocation for education in developing countries.

E5210.0600 Elvin, Lionel. "The Recruitment and Preparation of Teachers," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, 181-93.

An examination of one of the bottlenecks of educational expansion, the shortage of teachers, and possible measures to overcome it.

E5210.0700 Friedman, C.H. "Education of New York City Public School Teachers: An Economic Analysis," *Industry and Labor Relations Review,* (October 1964), 20-32.

Demonstrates that the rate of return to post baccalaureate teacher training in the New York City school system is negative relative to teachers with postgraduate preparation. It is argued that this fact accounts for the difficulties that N.Y.C. has experienced in recruiting highly trained teachers. (M. Blaug)

E5210.0900 Hansen, W.L. "Educational Plans and Teacher Supply," *Comparative Education Review,* (October 1962), 136-141.

A useful discussion of why American and British teacher forecasts have gone wrong with a brief review of the factors influencing changes in the demand and supply of teachers. (M. Blaug)

E5210.0920 Hansen, W. Lee. *Human Capital Requirements for Educational Expansion: Teacher Shortages and Teacher Supply.* Paper given at the Conference on Education and Economic Development, Comparative Education Center, University of Chicago, 4-6 April 1963. Chicago, Committee on Economic Growth, Social Science Research Council, 1963.

Following up the author's article in the *Comparative Education Review,* October 1962, this paper discusses in more detail problems of projecting the demand and supply of teachers, and also the concept of teacher shortage, from the point of view of realistically planning this facet of education. The author concludes that in this respect the African and Asian educational plans are realistic.

E5210.1000 International Labor Office. "The Determination of Teachers' Salaries," *International Labor Review,* (July 1959), 46-64.

The article summarizes information collected by ILO on the principles and criteria of rewarding primary and secondary teachers in a number of countries, including some analysis of the implications of the findings. (M. Blaug)

E5210.2000 Organization for Economic Cooperation and Development. *Supply, Recruitment and Training of Science and Mathematics Teachers.* Paris, OECD, n.d.

Using data from OECD countries, this short book discusses the supply and demand situation for teachers, methods of training, and the utilization of personnel. In conclusion recommendations are made for measures to alleviate the shortage of personnel revealed by the survey.

E5210.2100 Porter, R.C. "A Growth Model Forecast of Faculty Size and Salaries in U.S. Higher Education," *Review of Economics and Statistics,* (May 1965), 191-197.

A Harrod-Domar-type model is used to forecast faculty

size and salaries over the period 1960-1978. The model demonstrates that there is a determinate relationship between the birthrate and faculty size in higher education via successive enrollment rates in primary, secondary, and tertiary education. (M. Blaug)

E5210.2500 Stigler, G.J. *Employment and Compensation in Education.* National Bureau of Economic Research, Occasional Paper 33. New York, NBER, 1950.

An analysis of teachers' salaries since 1900, concluding that 'net advantages' of college teaching in 1941 exceeded those of dentistry and were almost equal to those of law and medicine. (M. Blaug)

E5210.3000 United Nations Educational, Economic, Scientific and Cultural Organization. *In-Service Training for Primary Teachers.* Geneva, International Bureau of Education, 1962. (Also published in French)

The study utilizes comparative national experience to show the extent and organization of training, methods, international measures, future plans, and the categories of staff involved. A second section gives in more detail the national responses from which these generalizations were derived.

E5210.3050 United Nations Educational, Economic, Scientific and Cultural Organization. *Shortage of Primary Teachers.* Geneva, International Bureau of Education, 1963. (Also published in French)

This study utilizes comparative national experiences to demonstrate the shortage, its causes, and steps taken to overcome it. The latter part gives in greater detail the national responses from which these comparative conclusions were derived.

E5210.3100 United Nations Educational, Scientific and Cultural Organization. *Training of Science Teachers for Secondary Schools.* Paris, UNESCO, 1961.

Given the importance of middle-level technical manpower in development, and its universal scarcity, the training of secondary-level science teachers becomes a crucial aspect of the teacher-supply problem which usually faces educational planners. An introductory essay discusses these training needs in general, and is followed by a series of brief accounts of national experiences.

International Aid

E5300.0300 Cerych, L. *Educational Aid to Developing Countries (Draft Report).* Paris, Atlantic Institute, April 1963.

This study is concerned to define the essentials of a consistent policy of external aid to education, which will enable such aid to be both coordinated and effective. Thus it is a first methodological approach to the aid problem for education.

E5300.0320 Cerych, L. *Problems of Aid to Education in Developing Countries.* New York, Frederick A. Praeger, 1965.

A thorough policy-oriented discussion of external aid to education, reviewing the estimates of the UNESCO regional plans, followed by a detailed analysis of the role of external aid at different levels of the educational system, concluding with suggestions for a rational aid policy. (M. Blaug)

E5300.0360 Curle, A. *World Campaign for Universal Literacy: Comment and Proposal.* Center for Studies in Education and Development, Graduate School of Education, Harvard University, Cambridge, Mass., CSED, 1964.

An excellent critique of the current World Campaign for Universal Literacy sponsored by UNESCO. The author recommends concentrating on the literacy of the labor force, rather than of the whole population. (M. Blaug)

E5300.0800 Grubel, H.B. and Scott, A.D. "The Cost of U.S. College Student Exchange Programs," *Journal of Human Resources,* (Fall 1966), 81-99.

A cost-benefit analysis of the foreign college student programme from the viewpoint of the United States, showing that the U.S. in recent years has derived an annual benefit of $16m. a year from the programme. (M. Blaug)

E5300.1500 Overseas Development Institute. *Aid to Education: An Anglo-American Appraisal.* Report of A Ditchley Foundation Conference. London, ODI, 1966.

The report of the conference, prepared by P. Williams, reviews British and American aid policies and sketches a programme for Anglo-American cooperation in educational aid to developing countries. (M. Blaug)

E5300.1520 Overseas Development Institute. *British Aid: Educational Assistance.* London, Overseas Development Institute Ltd., 1963.

A factual survey of the British educational aid effort, both public and private, for education in receiving countries and for students.

E5300.1800 Phillips, H.M. *International Aid for Educational Development in the Form of Technical Assistance and Real Resources.* Paper given at the International Economic Association Conference on the Economics of Education, Menthon St. Bernard, 29 August - 7 September 1963.

An account of the sources of aid to education and their scale, which deals specifically with technical and physical aid media, excluding the financial.

E5300.3000 Williams, Peter *Aid to Education: An Anglo-American Appraisal.* London, Overseas Development Institute, 1967.

Benefits

E5400.0100 Balogh, T. "Stagnation Through Education," *The Economics of Poverty,* London, Weidenfeld & Nicholson, 1966, p. 101-107.

An all-out attack on the human investment revolution in economic thought and on 'the fashionable conventional wisdom in the field of educational planning and policy in poor countries.' (M. Blaug)

E5400.0120 Balogh, T. and Streeten, P.P. "The Coefficient of Ignorance," *Bulletin of the Oxford University Institute of Economics and Statistics,* (May 1963), 99-107.

The article is mainly concerned with unwarranted extensions to underdeveloped countries of results derived from the experiences of industrialized countries, but along the way the authors express strong disagreement with American studies of the economic contribution of education. On the rate-of-return approach they say: 'The American data, which are mostly used, do not produce evidence as to whether expenditure on education is a *cause* or an *effect* of superior incomes; they do not show, even if we could assume it to be a condition of higher earnings, whether it is a *sufficient* or *necessary* condition of growth, and they do not separate *monopolistic* and *other forces* influencing differential earnings which are correlated with, but not caused by differential education.' Similar views are expressed in an earlier article by Balogh in *Times Educational Supplement*, June 8, 1962, pp. 1179. (M. Blaug)

E5400.0160 Becker, G.S. *Human Capital. A Theoretical and Empirical Analysis, with Special Reference to Education.* New York, National Bureau of Economic Research, Columbia University Press, 1964.

This magnum opus, incorporating and extending earlier studies by the author develops a general theory of human capital formation and applies it to such diverse phenomena as interpersonal, interracial and interregional differences in earnings, the shape of age-earnings and age-wealth profiles, and the rates of return from high school and college education in 1939 and 1949, corrected for variations in native ability and home environment. It is shown that private rates of return on college education exceed those on business capital, while social rates of return may be almost double the private rates on college education. A closing section on 'future research' sketches further work along similar lines contemplated by the author. (M. Blaug)

E5400.0180 Becker, G.S. "Underinvestment in College Education," *American Economic Review*, (May 1960), 346-354. "Comments" by H. Villard, *ibid.*, 375-378.

Preliminary results of a forthcoming National Bureau of Economic Research study, suggesting that the private rate of return from college education is not very different from the rate of return from business capital. This puts the burden of the contention of underinvestment on the public benefits of education, about which very little is known. The author contends that improvements in the quality of college education could raise the returns. Villard's comments deal with the question of measuring the public benefits. (M. Blaug)

E5400.0200 Bowen, William G. *Assessing the Economic Contribution of Education: An Appraisal of Alternative Approaches.* Paris, Organization for Economic Cooperation and Development. 11 May 1962.

Describes the various methods of attempting to measure returns to investment in education, in the process of discussing the difficulties involved in their use, and some of the drawbacks to which they are subject. Included are (1) the simple correlation approach; (2) the returns-to-education approach; (3) the residual approach; (4) the forecasting-manpower-needs approach.

E5400.0220 Bowman, J.J. "Converging Concerns of Economists and Educationalists," *Comparative Education Review*, (October 1962), 111-120.

A vigorous defense of the rate-of-return approach as most likely to lead to fruitful interdisciplinary communication between economists and educationalists. The private and public returns to education are clearly distinguished. (M. Blaug)

E5400.0240 Bowman, M.J. "The New Economics of Education," *International Journal of the Educational Sciences*, Vol. I, No. 1 (1964).

In this first issue of a new journal, the author discusses the factors that have led to the emergence of the subject of the economics of education. After a brief analysis of the role of literacy in economic development, the bulk of the paper is then devoted to an excellent review of recent rate-of-return studies of educational investment, (M. Blaug)

E5400.0260 Bowman, M.J. "Social Returns to Education," *International Social Science Journal*, Vol. XIV, No. 4 (1962), 647-660.

An analytical clarification of the nature of the public benefits of education. (M. Blaug)

E5400.0300 Burkhead, Jesse. "Education as a Production Process." Unpublished paper, Department of Economics, Syracuse University, 1966.

Surveys the difficulties inherent in using an input-output model for education, taking costs as input and 'benefits' as output. The difficulty is three-fold: it is hard to define benefits, benefits and costs are often not commensurable, the system tends to be open rather than closed no matter how costs and benefits are defined. Means of solving these problems are discussed, e.g., benefits can often be reduced to dollar terms.

E5400.0320 Butter, I.H. *Economics of Graduate Education: An Exploratory Study.* U.S. Department of Health, Education, and Welfare. Office of Education. Bureau of Research. Final Report. Ann Arbor, Michigan, The University of Michigan, 1966.

Calculates social rates of return to investment in American graduate education in four fields—Physics, Zoology, Sociology, and English—and compares these to rates of return at other levels of American higher education. (M. Blaug)

E5400.0400 Caine, S. "Education as a Factor of Production," *Lloyds Bank Review*, (April 1964), 1-17.

Some critical comments on current investigations of the investment return on education and brief discussions of various other topics in the econo[illegible] of education. (M. Blaug)

E5400.0420 Clark, H.F. "The Return on Educational Investment," *The Yearbook of Education, 1956.* London, Evans Brothers, 1956, 495-506. Reprinted in *Perspectives on the Economics of Education. Readings in School Finance and Management*, ed. C.S. Benson. Boston, Houghton-Mifflin, 1963.

A non-technical discussion, stressing the role of agricultural education in the development of the American economy. (M. Blaug)

E5400.0460 Coleman, J.S., (ed.). *Education and Political Development.* Princeton, New Jersey, Princeton University Press, 1965.

This collection of essays on the role of education in promoting political and social change includes several which touch on the economic contribution of education in developing countries. For instance, F.X. Sutton, 'Education and the Making of Modern Nations' (pp. 51-74) examines the part played by education in the growth of African nationalism; M. Debeauvais provides a description of

'Education in Former French Africa' (pp. 75-91); H. Passin's chapter on Japan repeats much of the material in his book. B.H. Hoselitz, in 'Investment in Education and its Political Impact', and W.J. Platt, in 'Conflicts in Educational Planning', introduces the reader to some of the economic literature. J.S. Coleman, in his introduction to each section stresses the need for educational planners and economists to consider the political implications of their policies. (M. Blaug)

E5400.0600 Edding, F. *Ökonomie des Bildungswesens. Lehren und Lernen als Haushalt und als Investition.* Feriburg, Verlag Rombach, 1963.

A collection of papers, some of which have never been put in print before, and excerpts from various books by the author which together cover the entire range of subject matter in the economics of education. The work includes an excellent bibliography. (M. Blaug)

E5400.0620 Educational Policies Commission, National Education Association of the United States. *Educational and Economic Well-Being in American Democracy.* Washington, D.C., National Education Association, 1940.

An omnibus of socio-economic arguments in favor of more education adressed to the interested layman. (M. Blaug)

E5400.0640 Eicher, J.C. "La Rentabilite de l'Investissement Humain," *Revue Economique,* July 1960, p. 577-609. Reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

After discarding measurement of the private rate of return to education, the author attempts to measure the social rate of return by a multiple-regression analysis of interstate and interregional differences in the U.S.A. (M. Blaug)

E5400.0660 Ellis, A.C. *The Money Value of Education.* Bureau of Education, Bulletin No. 22. Washington, D.C., Government Printing Office, 1917.

An early effort to prove that education constitutes profitable investment in human capital. Cites a large number of individual studies of the effects of education in different parts of the United States. The discussion of the problem is, however, somewhat naive. A detailed bibliography reveals the status of the subject in 1917. (M. Blaug)

E5400.0900 Halsey, A.H. (ed.). *Ability and Educational Opportunity.* Paris, Organization for Economic Cooperation and Development, 1961.

Series of papers discussing some factors relevant to the qualitative aspect of educational expansion. Useful in considering how to devote limited resources for education to those most able to benefit from them.

E5400.0920 Halsey, A.H., *et al. Education, Economy and Society.* New York, Free Press of Glencoe, 1962.

The essays in this book examine the significance of education in a technologically advancing society, particularly in its sociological aspects. Parts 1 and 2 are of most immediate relevance to the educational planner.

E5400.0940 Hansen, W.L. "Total and Private Rates of Return to Investment in Schooling," *Journal of Political Economy,* (April 1963), 128-141. Partly reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

In a significant contribution, the author presents internal money rates-of-return to both private and total investment in schooling and defends the rate-of-return approach as against the conventional additional-lifetime-income method employed by Miller and Houthakker. (M. Blaug)

E5400.0960 Hirsch, W.Z. and Marcus, M.J. "Some Benefit-Cost Considerations of Universal Junior College Education," *National Tax Journal* (March 1966), 48-57.

A rate-of-return analysis of a two-year college programme for the United States. (M. Blaug)

E5400.0980 Hirsch, Werner Z., *et al. Spillovers of Public Education Costs and Benefits.* Berkeley, Calif., Institute of Government and Public Affairs, University of California, 1964, p. 465.

E5400.1000 Holtmann, A.G. "A Note on Public Education and Spillovers through Migration," *Journal of Political Economy,* (October 1966), 524-526.

A critique of Weisbrod's thesis that migration of educated people constitutes an external effect; the argument is an application of Becker's competitive model in which profit-maximizing firms will not endure the cost of general on-the-job training. (M. Blaug)

E5400.1120 "Economics of Education," *International Social Science Journal,* Vol. 14, No. 4. (1962), 619-71.

Partial contents–Social returns to education, by Mary Jean Bowman–Teaching methods and their costs, by Charles Benson.

E5400.1200 Johnson, H.G., "The Social Policy of an Opulent Society," *Money, Trade and Economic Growth. Survey Lectures in Economic Theory.* London, G. Allen and Unwin, 1962, 180-195.

Some cogent remarks on the meaning and applicability of the rate-of-return approach to education. (M. Blaug)

E5400.1300 Kaser, M.C. *Problems of the Cost Benefit Analysis of Education.* Paper presented for the Economic Analysis Office of UNESCO. Paris, UNESCO, December 1965.

The first part of the paper considers a rather wider view of the returns to education than those of, e.g., Prest and Turvey and Baster (United Nations Research Institute for Social Development) in the context of the allocation of public finance on the one hand and the value of education to the beneficiary (Wiseman's psychic value). The second part of the paper sets out the concept of opposing costs to benefits, the third that of the costs of education, and the fourth the definition of benefits (considered in the perspective of the beneficiary, the time-stream of benefits and the benefit-maximand). A final part suggests lines for research which UNESCO might valuably sponsor; a bibliography is annexed.

E5400.1340 Khoi, L.T. "Le Rendement de l'Education," *Tiers-Monde. Problemses des Pays Sous-*

Developpes, (janvier-mars, 1964), 105-139.

A careful review of the literature on 'the residual approach' and 'the rate-of-return-approach' to the economic value of education. (M. Blaug)

E5400.1370 Le Thanh Khoi. *Le Rendement de L'Education.* Paris, United Nations Educational, Scientific and Cultural Organization, 2 January 1963. (To be published in the book *Planification Des Ressources Humaines* by M. Debeauvais and Le Thanh Khoi).

The author gives a detailed review of work in this field, most of which is in English, and concludes by noting the limited value of calculations of the yield and cost of education for individuals, in relation to the social costs and benefits which are the concern of the educational planner.

E5400.1600 Lobel, E. "Le Probleme du Financement," *Tiers–Monde,* Paris, Tome 1, No. 1-2 (janvier-juin 1960), 54-62.

Discussion of the difficulties of applying the economic concepts of cost and yield to education, taking into account such factors as educational wastage.

E5400.1700 Miller, W.L. "The Economics of Education in English Classical Economics," *Southern Economic Journal,* (January 1966), 294-310.

A schematic review of some leading questions that figured in classical writing on education: (1) education as human investment; (2) the economic objectives of education; (3) the effects of education on income distribution; (4) the scope of government action in education; and (5) methods of increasing the efficiency of education. (M. Blaug)

E5400.1720 Mushkin, Selma J., (ed.). *Economics of Higher Education.* Washington, D.C., U.S. Government Printing Office, 1962.

Higher Education as an Investment in People, p. 69-169.

E5400.1900 Peacock, A. and Lavers, R.J. "The Social Accounting of Education," *Journal of the Royal Statistical Society,* Series A, Vol. 129, Part 3 (1966), 448-466.

This paper develops a consistent production, consumption and financing account for educational services in any country, in the light of which it discusses the difficulty of measuring the contribution of education to G.N.P. The foregoing analysis is then used to evaluate the treatment of education in the published national accounts of the United Kingdom. (M. Blaug)

E5400.1920 Porter, Dr. Elias H. The Feasibility of Cost-Effectiveness Analysis for Title I, *Public Law 89-10.* First Interim Progress Report. Technomics Inc., Stamford, Conn., August 1, 1966.

This report describes the initial steps in setting up a cost-benefit analysis for experiments in education. The making of initial contacts and the setting up of communications are described along with a description of questions to be asked for defining costs and benefits and establishing uniform standards of reporting results.

E5400.1930 Porter, Dr. Elias H. *The Feasibility of Cost-Effectiveness Analysis for Title I, Public Law 89-10.* Second Interim Progress Report, Technomics, Inc., Stamford, Conn. November 1, 1966.

Problems encountered in determining costs are described and a preliminary list of expected benefits is drawn up. These benefits are classified as intermediate, final, and spinoff. Situations affecting benefit-cost relations which might arise are determined and ways are suggested for dealing with intangibles. This series is interesting in that it reports work in progress at close intervals and can be expected to show how assumptions are formed and reformed on the course of a cost-benefit analysis.

E5400.1960 Princeton University, Industrial Relations Section. *External Benefits of Education.* Princeton, N.J., 1964.

E5400.1980 "Public Finance and Education," *Public Finance,* Vol. 21, Nos. 1-2 (1966), 1-324.

Partial contents–The Theory of Spillovers and its Connection with Education, by Maurice Pestion–The Planning of Budgetry Expenditures on Education on the Basis of a Mathematical Model–the Method Employed in Hungary, by Lajos Faluvegi–Comment, by Alan T. Peacock–Public Finance and Education: A Summary of the Issues, by Jack Wiseman.

E5400.2000 Rado, E.R., "Cost-Benefit Analysis, Education, and Health," *Cost-Benefit Analysis of Social Projects.* Geneva, United Nations Research Institute for Social Development, April, 1966.

The value of cost-benefit analysis to underdeveloped countries is discussed. It is seen as highly unlikely that such countries could be convinced to pursue such programs and an alternative of trying to find ways of reducing the costs of approved programs is proposed. The main obstacle to acceptance of cost-benefit analysis as a planning tool in such countries is the difficulty of getting doctors and teachers to limit their professed aims. As an example, doctors try to provide the highest level of medical care for as many people as possible, whereas a cost-benefit analysis might show that it is more efficient to provide a low level of medical care for everyone, given that resources are very limited. Also, teachers strive to provide the longest possible education for as many pupils as can be provided for, whereas it might be found better to aim at universal elementary education for all, given that resources might be available for the full education of only a few percent of the whole population. This short paper sums up the felt lack in cost-benefit analysis that is only hinted at elsewhere: that maximizing *national* benefits is inherent in cost-benefit analysis and, therefore, that there are many who see it as a possible minimization of the benefits to the individual.

E5400.2100 Renshaw, E.F. "Estimating the Returns to Education," *Review of Economics and Statistics,* (August 1960), 318-324. Reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

A critical review of various estimates of the returns to education, a compendium of the shortcomings in this approach to resource allocation in education and, lastly, new estimates of income differentials due to education. (M. Blaug)

E5400.2150 Rivlin, A.M. "Research in the Economics of Higher Education: Progress and Problems," *Economics of Higher Education,* ed. S.J. Mushkin. Washington, D.C., Government Printing Office, 1962, p. 357-387.

An incomplete but illuminating survey of recent research

in (1) investment in education and the returns of such investment; (2) supply and demand for manpower; (3) methods of financing higher education. (M. Blaug)

E5400.2200 Sauvy, Alfred. *Social Factors in Education Plans.* Paris, UNESCO, 21 January 1963. (Draft chapter for the *Handbook on Economic and Social Aspects of Educational Planning.*)

After mentioning the importance of demographic factors in educational planning, the author considers the effect of social inequality on education, the relation between education and employment, and the influence of education on social stratification.

E5400.2220 Saxe, Jo W., "Some Questions About the Economics of Education," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963. p. 49-55.

A series of critical remarks on the various methods of looking at the economics of education, in particular its returns and its costs and problems of resource allocation.

E5400.2300 Schramm, W. *Mass Media and National Development: The Role of Information in the Developing Countries.* Stanford, California, Stanford University Press, and Paris, UNESCO, 1964.

A study of the impact of mass communication on economic and social change, which includes a discussion of the use of mass media in formal education and adult literacy campaigns and the costs of improving methods of communication in developing countries. (M. Blaug)

E5400.2320 Schultz, T.W. "Capital Formation by Education," *Journal of Political Economy,* (December 1960), 571-584.

In this fundamental article, Schultz estimates human capital formation in the U.S.A. since 1900 as a sum of the earnings foregone by students and the costs of educational services provided by schools. A shortened version of this article appears in *Economics of Higher Education,* ed. S.J. Mushkin, Washington, D.C., Government Printing Office, 1962. (M. Blaug)

E5400.2340 Schultz, T.W. *The Economic Value of Education.* New York, Columbia University Press, 1963.

A useful review of recent American work on the costs and economic benefits of education, with a chapter on 'unfinished research' and a comprehensive bibliography of over 200 items under five headings. (M. Blaug)

E5400.2360 Schultz, Theodore W., *et al.* "Investment in Human Beings". *Journal of Political Economy,* Vol. LXX, No. 5, Part 2. Supplement (October 1962).

The series of articles contained in this Supplement is of interest in that it endeavors to subject education to economic analysis. However the value of this for the educational planner in a developing country is limited because the analysis is mostly carried out with reference to the American educational system, and hence it is very questionable how far its conclusions are transferable to the situations of other countries.

E5400.2380 Sen, A.K. "Education, Vintage, and Learning by Doing," *Journal of Human Resources,* (Fall 1966), 3-22.

An important article that constructs and tests a simple 'vintage' model of investment in labour quality, relating work experience to formal educational preparation. The model's major predictions–that the rate of increase of productive ability will decline with age and that the productive ability profile will have a single peak–are tested with the aid of data from the U.S. Census of 1960 and the Canadian Census of 1961. (M. Blaug)

E5400.2400 Sloan, Harold S. "La Educacion y el Desarrollo Economico," *La Educacion,* Ano V, No. 17 (enero-marzo 1960), 48-62.

The article discusses how education influences habits, such as those of saving and investment, necessary for development, as well as its effect in helping the formation of skilled labour.

E5400.2420 Smelser, N.J. and Lipset, S.M., "Social Structure, Mobility and Development," *Social Structure and Mobility in Economic Development,* eds. N.J. Smelser and S.N. Lipset. London, Routledge & Kegan Paul, 1966, p. 1-51.

A broad view of the evidence, half of which is devoted to the impact of education on social and economic development in low-income countries. (M. Blaug)

E5400.2440 Stanford Research Institute. *Evaluating the Effectiveness of the Compensatory Education Program of the San Francisco Unified District.* Proposal No. 1-66-10. Menlo Park, California, SRI, January 14, 1966.

E5400.2500 Tawney, R.H. *Some Thoughts on the Economics of Public Education.* L.T. Hobhouse Memorial Trust Lectures, No. 8. London, Oxford University Press, 1938.

In this remarkable pamphlet, Tawney advocates expansion of education on the grounds that, among other things, education is a way of 'investing in human beings'. Fifteen years before economists turned their attention to what he calls 'that repulsive hybrid', the economics of education, Tawney grasped most of the issues: 'Since, in short, economic considerations necessarily carry weight, it is important to form some idea, at least, of what they weigh'; 'the benefit of education to the boys and girls concerned is weighed against the loss to employers of their services as errand-boys or little piecers, and to parents of their earnings'; England must learn 'to depend less on cheap coal and more on trained intelligence'. (M. Blaug)

E5400.2540 Training Corp. of America, Inc. *A Proposal to Develop Analytical Techniques and Measures For An Education Cost-Benefit Model.* Falls Church, Virginia, Training Corp. of America, Inc., 1966.

E5400.2580 Tunes, J.T., Jacobson, P.B. and Pellegrin, R.J. *The Economic Returns to Education. A Survey of the Findings.* Eugene, Oregon, Center for the Advanced Study of Educational Administration, 1965.

A straightforward summary of the work of Schultz, Lee Hansen, Miller and Denison, with a brief bibliography of rate-of-return literature. (M. Blaug)

E5400.2700 Vaizey, J., "Criteria for Public Expenditures on Education," *International Economic Association Conference on the Economics of Education,* London, Macmillan, 1965.

After a quick once-over-lightly review of the debate, Vaizey concludes: 'I am more agnostic on the matter of the contribution of education to economic growth than a number of more recent converts to the cause. I am doubtful whether, in the long run, the concepts of education as 'investment' will prove much of a guide on what 'ought' to be spent on education.' (M. Blaug)

E5400.2720 Vaizey, J. *The Economics of Education.* London, Faber & Faber, 1962. Also New York, The Free Press of Glencoe, 1962.

A brief book, written in a controversial style, which covers almost every aspect of the subject. The first chapter on 'What Some Economists Said About Education' and the third chapter on 'The Returns to Education' are reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey; Paris: UNESCO, 1964. Ch. 2 discusses whether education is investment or consumption, dealing at the same time with the question of private versus public education. Ch. 4 looks at patterns of national expenditures on education. Ch. 5 considers educational finance. Ch. 6 treats the productivity or efficiency of education conceived as an industry. Ch. 7, perhaps the best chapter in the book, analyzes manpower problems. Ch. 8 deals with trends in teachers' salaries. Ch. 9 is concerned with the 'pool of ability'. The last two chapters take up the question of education in underdeveloped countries. A select bibliography is included. (M. Blaug)

E5400.2740 Vaizey, J. "The Present State of the Economics of Education," *International Social Science Journal,* Vol. XIV, No. 4 (1962), 619-633. Reprinted in J. Vaizey, *The Control of Education,* London, Faber & Faber, 1963, p. 17-35.

A brief review of the subject with some pessimistic remarks about the value of the rate-of-return approach. (M. Blaug)

E5400.2760 Vosgerau, H.J. "Ueber Kosten und Ertrage Von Ausbildungsinvestitionen," *Kyklos,* Vol. XCIII, No. 3 (1965), 434-450.

A review of American work on the rate of return on investment in college education, with critical remarks on the neglect of the external effects of education. (M. Blaug)

E5400.2780 Vuaridel, R. "Capital Humain et Economie de l'Education," *Sweizerische Zeitschrift fur Volkswirtschaft und Statistik,* June 1963, p. 193-219.

Stresses the importance of the indirect benefits of education which are likened to consumer durables in contrast to the direct benefits which are in the nature of producer goods. Seems to deny that the indirect benefits are associated with increases in national income. (M. Blaug)

E5400.2900 Walsh, J.R. "Capital Concept Applied to Man," *Quarterly Journal of Economics,* (February 1935), 255-285. Partly reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

This perceptive article, written long before the current interest in 'human capital', considers the returns from formal schooling on the basis of college graduates. The approach is that of looking at the present value of future returns, discounted at 4%. All the limitations of this type of research are mentioned and briefly discussed. A lengthy footnote cites the relevant literature between 1700 and 1935 (for a detailed review of the history of the concept of human capital, see L.I. Dublin, A.J. Lotka, *The Money Value of a Man.* N.Y.: The Ronald Press, 2d. ed., 1946, ch.2, pp. 6-21). (M. Blaug)

E5400.2920 Weckstein, R.S. "Welfare Criteria and Changing Tastes," *American Economic Review,* (March 1962), 133-154.

In a reaction to traditional economic welfare analysis, based on the assumption that individual tastes remain constant, the author redefines economic welfare to depend on both real income and the 'level of aspiration' for real income. A number of surprising conclusions are drawn from the fact that welfare so defined is positively associated with real income but negatively associated with aspiration-levels; among these is the demonstration that an optimal educational budget in an underdeveloped country which takes account of the aspiration-increasing effects of education is always smaller than one based on fixed tastes (pp. 148-151). (M. Blaug)

E5400.2940 Weisbrod, B.A. "Education and Investment in Human Capital," *Journal of Political Economy,* Supplement (October, 1962), 106-124.

Clarifies the measurement of the private benefits of education by considering some elements usually neglected, and contributes fresh ideas on the measurement of the public benefits. (M. Blaug)

E5400.2960 Weisbrod, B.A. *External Benefits of Public Education.* Princeton, N.J., Industrial Relations Section, Princeton University, 1964.

This important pamphlet is an extension and elaboration of the author's earlier article. (See "Education and Investment in Human Capital," *Journal of Political Economy,* Supplement, October 1962, pp. 106-124.) (M. Blaug)

E5400.2980 Weisbrod, Burton A., "Preventing High School Dropouts," In Dorfman, Robert, ed. *Measuring Benefits of Government Investments.* Papers presented at a conference of experts, Nov. 7-9, 1963. Washington, Brookings Institution, 1965, p. 117-171.

The paper begins by differentiating between costs and benefits to society and to the individual and shows that under certain conditions dropping out of school is the solution which maximizes benefits and minimizes costs to the individual—and sometimes also to society. Notes that even so it could be better to prevent dropouts in order to obtain a better distribution of wealth and greater participation in democratic processes. A report is given on an actual program in which costs were found to be higher than benefits, and under the specific circumstances of this case it is shown that costs and benefits can be in balance only if the program is started before age 16.

E5400.3000 Wiseman, Jack. "Cost-Benefit Analysis in Education," *Southern Economic Journal,* Vol. 32, Supplement, (July 1965) 1-14.

Benefits – For Economic Growth

E5410.0100 Abramovitz, M. "Economic Growth in the United States," *American Economic Review,* Vol. LII, No. 4 (September 1962), 762-82.

A review of Denison's work on economic growth in the United States, which deals in passing with the contribution of education, and is critical of Denison's results in this aspect of his work.

E5410.0120 American Association of Colleges for Teacher Education. *Educational Investment in the Pacific Community.* Washington, D.C., American Association of Colleges for Teacher Education. 1963.

The articles comprising this report include several referring to the educational experiences and needs of various Pacific countries, particularly in relation to their economic growth.

E5410.0140 Anderson, C. Arnold. *Equity, Efficiency and Educational Opportunity in Relation to Economic Development.* Paper given at the Conference on Education and Economic Development, Comparative Center, University of Chicago, 4-6 April 1963. Chicago, Committee on Economic Growth, Social Science Research Council, 1963.

Drawing extensively on examples, both from the historical experience of the West, and the contemporary underdeveloped countries, the author discusses the relation of access to education to educational performance with reference to development, suggesting that universal access is not the most important factor in enabling education to contribute to development, with consequences for the scale of educational efforts needed.

E5410.0160 Arthur D. Little, Inc., *Georgia Institute of Technology: Role in Economic Development.* New York, Arthur D. Little, Inc., n.d.

The Alumni Association of Georgia Tech asked ADL to review the research conducted by the Institute's faculty and Engineering Experiment Station in order to determine whether the economic development of the Atlanta area and of the State of Georgia could be accelerated by expanded or redirected programs of applied research. (Author)

E5410.0200 Balogh, T. "Education and Economic Growth. Comments on Professor Tinbergen's Planning Model," *Kyklos,* Vol. XVII, No. 2 (1964) 261-273. "Reply" by J. Tinbergen, *ibid.*, 274-275. Reprinted in *The Residual Factor and Economic Growth,* ed. J. Vaizey, Paris, Organization for Economic and Cultural Development, 1964.

This critique of the Correa-Tinbergen model denies the possibility of discovering any numerical relationship between education and economic growth. The reply admits Balogh's practical objections but defends the notion of stable relations between economic variables and education. (M. Blaug)

E5410.0220 Baster, N. and Subramanian, M. *Aspects of Social and Economic Growth.* Report No. 1. Geneva, U.N. Research Institute for Social Development, 1965.

This preliminary study of patterns of social and economic development in both developed and underdeveloped countries carries on the work begun in the 1961 U.N. Report on the World Social Situation. It calculates rank correlation coefficients between various indicators of economic growth and selected social indicators from the fields of education and health for 18 countries in the years 1950 to 1960. The authors stress the tentative character of their conclusions (see pp. vii-viii, 3, 44-47.). (M. Blaug)

E5410.0240 Benham, F. "Education and Economic Development in Underdeveloped Countries," *International Affairs,* (April 1959), 181-188.

A leading economist attacks the illusion of universal primary education in underdeveloped countries in the near future and denies that educational expenditures are very profitable investment for most underdeveloped countries in the world today. (M. Blaug)

E5410.0260 Blot, D. and Debeauvais, M. "Les Depenses l'Education dans le Monde. Une Analyse Statistique," *Tiers-Monde. Problemes des Pays Sous-Developpes.* (avril-juin, 1965), 443-463.

A multi-regression analysis of the relationship between educational expenditures and GNP in 95 countries, which is then applied to evaluate the targets of the 3 regional educational plans for Asia, Africa, and Latin America. (M. Blaug)

E5410.0280 Bottomley, A. "Optimum Levels of Investment in Education and Economic Development," *Zeitschrift fur die Gesamte Staatswissenschaft.* April 1966, 237-246.

A brief theoretical note on the costs of and returns to education in developing countries. The references to the literature are somewhat out-of-date. (M. Blaug)

E5410.0300 Bowman, Mary Jean. *Education and Economic Growth: Some Methods and Issues of Measurement Re-Examined.* Economics of Education Research Paper No. 63-4. Chicago, University of Chicago, 24 April 1963.

The issues dealt with include the scale of resource allocations to education, the contribution of educational expansion to the growth of national income and economic growth, the relation of education to income distribution, and the relative importance in these matters of schooling and on-the-job training.

E5410.0320 Bowman, J.J. "Schultz, Denison and the Contribution of Education to National Income-Growth," *Journal of Political Economy,* October 1964.

The article compares the measurements of Schultz and Denison with the aid of a rental-value model of educational inputs, concluding with a critique of theoretical foundations and concepts. (M. Blaug)

E5410.0340 Bowman, M.J. and Anderson, C.A., "Concerning the Role of Education in Development," *Old Societies and New States. The Quest for Modernity in Asia and Africa,* ed. C. Geertz. Glencoe, Ill., The Free Press, 1963, p. 247-280. Reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

Perhaps the best effort to date to see what can be learned from correlations between income and education around the world. The results are briefly reviewed elsewhere, but they are only fully developed here. (M. Blaug)

E5410.0360 Bowman, J.J. and Anderson, C.A., "The Role of Education in Economic Development,"

Development of the Emerging Countries. An Agenda for Research. Washington, D.C., The Brookings Institution, 1962, p. 153-181.

Presents preliminary results of an original research project and lists additional topics on which research is needed. (M. Blaug)

E5410.0400 Correa, H. *The Economics of Human Resources.* Amsterdam, North-Holland Publishing Co., 1963. Excerpts reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Deveauvais, and J. Vaizey. Paris, UNESCO, 1964.

A book which purports to present an integrated treatment of the economics of education and health, but in fact covers only part of the field. The most original part of the book is the penultimate chapter which develops a Harrod-Domar-type growth model with specific educational coefficients; the resulting system proves to be mathematically insoluable. (M. Blaug)

E5410.0420 Curle, A. "Education, Politics and Development," *Comparative Education Review,* (February 1964) 226-245.

An interesting attempt to test some generally held notions about various relationships between a country's level of economic, political and educational development by means of quantitative indicators. (M. Blaug)

E5410.0600 Eckaus, R.S., "Education and Economic Growth," *Economics of Higher Education,* ed. S.J. Mushkin. Washington, D.C., Government Printing Office, 1962. Partly reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

After some introductory remarks on the theme stated in the title, various measures of the economic contribution of education are critically reviewed. A number of topics are touched upon and, in every case, the author adds something new to the discussion. (M. Blaug)

E5410.0900 Griliches, Z. "The Sources of Measured Productivity Growth: U.S. Agriculture, 1940-1960," *Journal of Political Economy,* (August 1963), 331-347.

Discarding the traditional production-function approach, the author measures the change in total output by holding the production function constant and attributing the extra output to changes in the quantity and quality of inputs and to economies of scale. He finds that the rise in the educational levels of U.S. farmers accounts for one-third of conventionally measured productivity increases over the last twenty years. (M. Blaug)

E5410.0920 Groves, H.M. *Education and Economic Growth.* Washington, D.C., The Committee on Educational Finance. National Education Association, 1961. Excerpts reprinted in *Perspectives on the Economics of Education. Readings in School Finance and Management,* ed. C.S. Benson, Boston, Houghton-Mifflin, 1963. p. 7-12.

A popular but cogent review of recent American findings about the gains from investment in education, and a brief discussion of the problems of manpower wastage and educational finance in the U.S.A. (M. Blaug)

E5410.1000 Kaser, M.C., "Education and Economic Progress: Experience in Industrialized Market Economies," *International Economic Association Conference on the Economics of Education.* London, Macmillan, 1965, 89-174.

An example of the simple-correlation approach applied to a dozen industrialized countries, relating GNP per head as well as the growth rate of GNP to five separate indicators of educational density, to student/staff ratios, to educational expenditures per student, and to teachers' salaries. (M. Blaug)

E5410.1020 Khoi, Le Thanh. "Dimension Historique de l'Education." *Tiers-Monde. Problemes des Pays Sous-Developpes.* (avril-juin 1965), 335-357.

General comments on the treatment of education in the history of economic thought and on the role of education in the underdeveloped countries today. (M. Blaug)

E5410.1100 Lauwerys, J.A., *et al,* eds. *Yearbook of Education. The Role of Education in Social and Economic Development, 1954; Economics and Education, 1956; Higher Education, 1959.* University of London Institute of Education and Teachers College, Columbia University, London, Evans Bros., 1954, 1956, 1959.

These yearbooks deal with a single theme and contain contributions from experts all over the world. The three volumes cited each contain several articles falling within the economics of education, the most important of which are listed separately below. (M. Blaug)

E5410.1120 Le Thanh Khoi. *Education et Investissement.* Paris, Institut d'Etude du Develloppement Economique et Social, 27 December 1962. To be published in the book *Planification des Ressources Humaines,* by M. Debeauvais and Le Thanh Khoi.

A review of the historical evidence of the relation of education to economic development, including the opinions of some great economists, concluding with remarks on the distinctiveness of the desirable future relationship in developing countries.

E5410.1140 Lewis, W.A. "Priorities for Educational Expansion," *Policy Conference on Economic Growth and Investment in Education,* Part 3. Paris, Organization for Economic Cooperation and Development, 1962, p. 35-49.

(This article has also appeared under the title "Education and Economic Development" in *Social and Economic Studies,* Vol. 10, No. 2, June 1961, and in *International Social Science Journal,* Vol. XIV, No. 4, (1962), 685-699)

Some very pertinent comments on the relative importance of different levels of education and their expansion in relation to the growth of underdeveloped countries.

E5410.1200 McClelland, D.C. "Does Education Accelerate Economic Growth?" *Economic Development and Cultural Change.* April 1966, 257-278.

An important article that relates secondary school enrollments and the stock of educated adults to measures of electricity consumption in different countries around the world. It also looks at the interaction between

achievement-motivation, as measured by McClelland's *n* achievement test, educational levels, and economic growth, showing that in the 1950's achievement motivation was negatively associated with rapid expansion of secondary education. In the final pages of the paper, the author calculates the average productivity of higher education, where the numerator of the productivity figure refers to G.N.P. per head 3-4 years later; this productivity is misleadingly called 'a rate of return.' (M. Blaug)

E5410.1220 McKie, J.W., ed. "Education and the Southern Economy," *Southern Economic Journal,* Supplement, (July 1965), 1-128.

The five papers in this volume were originally delivered at a conference on Education and Human Resources sponsored by the Inter-University Committee for Economic Research on the South. The first paper, 'Cost-Benefit Analysis in Education' by J. Wiseman, raises some skeptical questions about the policy implications of rate-of-return analysis which Schultz answers in a comment (pp. 1-15), W.C. Stubblebine's 'Institutional Elements in the Financing of Education', with comments by E.F. Renshaw (pp. 15-39) is a path-breaking essay: using a simplified analytical model with differences in family preferences for education as a function of family shares of the tax base, he tries to show that educational systems which combine private and public finance will elicit maximum financial support. A.M. Cartter applies the authoritative-opinion principle to the ordinal measurement of 'Qualitative Aspects of Southern University Education' with comments by H.G. Schaller (pp. 39-73). M.J. Bowman's 'Human Inequalities and Southern Underdevelopment', with comments by A.M. Rivlin (pp. 73-106) is concerned with various measures of underdevelopment of the human resources of the South. R. Fein supplies additional detail on 'Educational Patterns in Southern Migration'; with comments by W.N. Parker (pp. 106-128). (M. Blaug)

E5410.1400 Organization for Economic Cooperation and Development. *Policy Conference on Economic Growth and Investment in Education.* Paris, OECD, 1962.

Contains, among other things, speeches by Dean Rusk, U.S. Secretary of State, P.H. Coombs, chairman of the Conference, and Mr. W.H. Heller, Kennedy's Chairman of the Council of Economic Advisors, all of which pay tribute to the concept of 'investment in human capital.' (M. Blaug)

E5410.1500 Platt, William J. "Investing in Education," *Stanford Research Institute Journal,* Vol. 5, Second Quarter (1961), 49-57.

A brief survey of education as an investment for development, written from an American liberal viewpoint.

E5410.1600 Sanders, Donald P., "A Proposal for Research in the Qualitative Aspects of Education," *Planning Education for Social and Economic Development.* Paris, Organization for Economic Cooperation and Development, 1963. p. 266-70.

The proposal stresses the need to consider the nature of the education received if desired social and economic benefits are to be derived from educational investment.

E5410.1700 Schultz, T.W., "Education and Economic Growth," *Social Forces Influencing American Education. The Sixtieth Yearbook of the National Society for the Study of Education,* ed. N.B. Henry. Chicago, Ill., Chicago University Press, 1961. Part II, p. 46-88. Summary reprinted in *Education, Economy, and Society,* eds. A.H. Halsey, J. Floud, and C.A. Anderson. Glencoe, Ill., Free Press, 1961, p. 50-52, and in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey, Paris, UNESCO, 1964.

An exploratory study with many tables of supporting data also presented in other publications by the author. (M. Blaug)

E5410.1720 Schultz, T.W. *Education as a Source of Economic Growth.* Santiago, United Nations, 19 February 1962.

The author emphasizes the comparative novelty of the economic approach to education, discusses the application of economic concepts, and examines the place of education in economic growth.

E5410.1740 Schultz, T.W. "The Emerging Economic Scene and Its Relation to High School Education," *The High School in a New Era,* ed. F.S. Chase and C.A. Anderson. Chicago, Ill., Chicago University Press, 1958, p. 97-113.

A discursive article which at one point attributes Britain's slow rate of growth relative to the U.S.A. to lower school enrollment in Great Britain. (M. Blaug)

E5410.1780 Svennilson, I., "The Concept of Economic Growth," *Proceedings of the Eleventh International Conference of Agricultural Economists. The Role of Agriculture in Economic Development.* London, Oxford University Press, 1963, p. 18-29.

Tries to show how different parameters related to growth may be included in a collective decision-model, using education as an example of such a parameter. (M. Blaug)

E5410.1800 Svennilson, Ingvar. "Education, Research, and Other Unidentified Factors in Growth." Paper given at the 1962 Conference of the International Economic Association, Vienna.

An economist's view of the posited relation of education to economic growth.

E5410.3000 United Nations Educational, Scientific and Cultural Organization. *The Relationship Between the Literacy Campaign and Economic Development.* Paris, UNESCO, 18 June 1962.

Discusses the economic significance of literacy education, and in the light of this offers estimates of the costs of a world literacy campaign during the development decade.

E5410.3500 Vaizey, John, "The Role of Education in Economic Development," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, p. 39-47.

In this article the author emphasizes the role of qualitative rather than quantitative improvements in the educational system in terms of their effect on future development.

E5410.3600 Youngson, A.J. *Possibilities of Economic Progress.* London, Cambridge University Press, 1959.

A discussion of the nature and causes of economic progress and its acceleration, drawing on the views of economists of the past is followed by some historical studies to examine the concepts developed. The place of education is referred to, with specific references to its importance in Denmark and the U.S.A.

E5410.0500 Denison, E.F. *The Sources of Economic Growth in the U.S. and the Alternatives Before Us.* Committee for Economic Development, Supplementary Paper No. 13. N.Y., CED, 1962, Ch. 7, p. 67-80. Reprinted in *Perspectives on the Economics of Education. Readings in School Finance and Management,* ed. C.S. Benson. Boston, Houghton Mifflin, 1963, p. 33-42.

One of the most ambitious attempts to quantify the contribution of formal education to economic growth in the context of an aggregate-production-function-model for the U.S. economy. It includes a notable attempt to estimate the growth effects of raising the school-leaving age by one year. See the valuable review article by M. Abramovitz in *American Economic Review,* September 1962, particularly pp. 769-771, concluding that 'Denison has probably not been successful in approximating the contribution made by the rise in the level of education to our past growth' on the grounds that he ignored the indirect public benefits. See also E.F. Denison, 'Measuring the Contribution of Education to Economic Growth', *The Residual Factor and Economic Growth,* ed. J. Vaizey, Paris: OECD, 1964, reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey, Paris: UNESCO, 1964, where the author defends some of his assumptions and applies a similar approach to a comparison between the U.S.A., the U.K., and Italy. (M. Blaug)

Benefits – For Agriculture

E5420.0400 Gisser, M. "Schooling and the Farm Problem," *Econometrica,* (July 1965), 582-592.

This article reports on the results of an econometric study of the relationship between the level of schooling in American farm areas and for income of farm workers. It estimates supply and demand functions for farm labor, incorporating the level of schooling as a predetermined variable, and concludes that the net effect of more schooling would be to raise incomes in rural areas and to encourage farm outmigration. The closing section estimates the cost of raising the level of schooling in rural farm areas from an average of 8 to an average of 12 years. (M. Blaug)

E5420.2000 U.S. Department of Agriculture. *Economic Factors Influencing Educational Attainments and Aspirations of Farm Youth.* Washington, D.C., 1964.

E5420.3000 Wharton, Clifton R. *Education and Agricultural Growth.* Chicago, Social Science Research Council, 1963.

An examination of the ways in which education contributes to agricultural development. The author is concerned to expose the shortcomings of universal primary education as an optimal educational aim in economic development, particularly of the agricultural sector. This is followed by discussion of the educational needs of agriculture in the early stages of economic growth.

Benefits – For Individual Income

E5430.0200 Becker, Gary S. and Chiswick, Barry R. "The Economics of Education. Education and the Distribution of Earnings," *American Economic Review,* Vol. 56, (May 1966), 358-400.

Contents.–Education and the distribution of earnings, by Gary S. Becker and Barry R. Chiswick.–Investment in the education of the poor: a pessimistic report, by Eugene Smolensky.–Measurement of the quality of schooling, by Finis Welch.–Discussion, by Alice M. Rivlin, Lee R. Martin, and Andre Daniere.

E5430.0220 Becker, G.S. "Education and the Distribution of Earnings," *American Economic Review,* (May 1966), 358-370)

The sketch of a theory of personal income distribution based on the effects of education and training received by individuals, together with some empirical results explaining regional income differences in the United States by variations in the amount of schooling. (M. Blaug)

E5430.0260 Bowyer, V., "Measuring the Economic Value of Education to the States," *Improving Educational Research.* 7th Official Report of the American Educational Research Association. Washington, D.C., AERA, 1948, p. 170-178.

An example of the simple-correlation approach to the economic value of education. Finds a positive relationship between the percentage of income expended on public education in American states and per capita state income through the period 1890-1946, but the analysis is conducted for groups of states rather than for individual states. (See also the author's 'Financial Support for Education and Subsequent Economic Progress of States', *Elementary School Journal,* February, March, 1950, pp. 318-325, 396-405.) (M. Blaug)

E5430.0280 Bridgeman, S., "Problems in Estimating the Monetary Value of College Education," *Higher Education in the U.S.A. The Economic Problems,* ed. S.E. Harris. Cambridge, Mass., Harvard University Press, 1960, p. 180-185.

A brief critical review of American findings. (M. Blaug)

E5430.0300 Committee of Economic Development. *Raising Low Incomes Through Improving Education.* A Statement on National Policy by the Research and Policy Committee of the C.E.D. New York, C.E.D., 1965.

An interesting attempt to formulate a national educational policy for the United States along what might be called 'liberal' lines. (M. Blaug)

E5430.0400 Denison, E.F., "Proportion of Income Differentials Among Education Groups 'due to' Additional Education: The Evidence of the Wolfle-Smith Survey," *The Residual Factor and Economic Growth,* ed. J. Vaizey. Paris, Organization for European Cooperation and Development, 1964.

In this important addendum to *The Sources of Economic Growth,* Denison examines new evidence to justify his attribution of 3/5th of the income differentials among males of the same age to formal education. See also his

spirited reply to the critical comments by E. Lundberg and E. Sundee in the same volume. (M. Blaug)

E5430.0440 Duncan, O.D. "Occupational Components of Educational Differences in Income," *Journal of the American Statistical Society*, (December 1961), 783-792.

Presents a method of making inferences about the role of occupational selection in the absence of a simultaneous cross-tabulation of income by occupation and by education. Concludes that occupation is a major intervening factor in the relationship between education and income. (M. Blaug)

E5430.0700 Glick, P.C. and Miller, H.P. "Educational Level and Potential Income," *American Sociological Review*, Vol. XXI (1956), 307-312.

An early attempt, extending P.C. Glick's 'Educational Attainment and Occupational Advancement,' *Transactions of the Second World Congress of Sociology*, II. London: 1954, pp. 183-193, which produced the oft-cited figure of $100,000 as the lifetime income benefit of attending American college. The authors deduct educational costs from returns and conclude that investment in college education pays better than most investments. (M. Blaug)

E5430.0800 Harris, S.E. *The Market for College Graduates and Related Aspects of Education and Income.* Cambridge, Massachusetts, Harvard University Press, 1949.

In this book the author argues the imminence of an excess of college graduates in the U.S.A., a viewpoint which he has since abandoned. The essential analyses and conclusions are presented in the first 75 pages; the rest of the book contains most of the documentation and supporting statistics. Many useful tables and charts are included. (M. Blaug)

E5430.0820 Hirsch, W.Z. and Segelhorst, E.W. "Incremental Income Benefits of Public Education," *Review of Economics and Statistics*, (November 1965), 392-399. Also Institute of Government and Public Affairs, University of California, Los Angeles, Reprint No. 17.

Using the results of sample survey data collected in 1957 for the St. Louis City-County area, the authors calculate regression coefficients representing the net effect of education on income, after adjusting for race, sex, mortality, occupation, self-employment and supervisory status, occupation of father, years of work experience, migration from the Deep South, size of birthplace, and quality of education in terms of per pupil expenditure. They find very high rates of return and compare their results with those of Lee Hansen, Miller, and Becker. (M. Blaug)

E5430.0840 Houthakker, H.S. "Education and Income," *Review of Economics and Statistics*, (February 1959), 24-28.

A sophisticated attempt to measure the present value of lifetime income from various years of schooling, using 1950 Census data, and concluding with some widely quoted qualifications about this approach to the economic benefits of education. (M. Blaug)

E5430.0880 Hunt, S.J. "Income Determinants for College Graduates and the Return to Educational Investment," *Yale Economic Essays.* Fall 1963.

An attempt by means of multiple regression analysis to improve estimates of the income-benefits of college education in the U.S.A. by studying the effect of an improved quality of undergraduate education on the yield of investment in graduate education. (M. Blaug)

E5430.1500 Miller, H.P. "Lifetime Income and Economic Growth," *American Economic Review*, (September 1965), 834-844.

Argues that the usual methods of estimating lifetime incomes associated with education from cross-section surveys of earnings tend to produce under-estimates of the rate of return on investment in education because of the failure to take account of the future growth of income. No reference is made to Becker's book *Human Capital* where this factor is discussed and taken into account. (M. Blaug)

E5430.1540 Morgan, J.N. and David, M.H. "Education and Income," *Quarterly Journal of Economics*, (August 1963), 423-438.

Multivariate analysis is used to derive estimates of the effects of education on hourly earnings, indicating that the objections to the use of simple average earnings of different age and education groups on grounds of spurious correlation are correct but quantitatively unimportant. See also J.N. Morgan, C. Lininger, "Education and Income: Comment," *ibid.*, May 1964, pp. 346-347. (M. Blaug)

E5430.1580 Musgrove, F. "Middle-Class Education and Employment in the Nineteenth Century," *Economic History Review*, (August 1959), 99-112.

Drawing on the evidence of novelists, social commentators, and the findings of the School Inquiry (Taunton) Commission of 1868, the author tries to show that the rapid growth of middle-class education in the second quarter of the century was not matched by the expansion of middle-class employment. H.J. Perkin denied Musgrove's entire argument in 'A Critical Note,' *ibid.*, Vol. XIV, No. 1, 1961, pp. 122-130, which drew 'A Rejoinder' from Musgrove, *ibid.*, Vol. XIV, No. 2, 1961, pp. 320-329. The material utilized by Musgrove also appears in a different context in the author's study of *The Migratory Elite.* London: Heinemann, 1963. (M. Blaug)

E5430.1900 Sexton, P.C. *Education and Income. Inequalities of Opportunity in Our Public Schools.* New York, The Viking Press, 1961.

A study addressed to the layman of a single large, Northern, urban public school system, dealing with the economic, racial and sexual barriers to equality of educational opportunity. (M. Blaug)

E5430.1920 Smolensky, E. "Investment in the Education of the Poor: A Pessimistic Report," *American Economic Review*, (May 1966), 370-378.

An interesting analysis of increased schooling as an anti-poverty policy under conditions of full and less than full employment, concluding with some pessimistic comments on the efficacy of this policy under present conditions. See the comments of A.M. Rivlin, *ibid.*, pp. 396-398. (M. Blaug)

E5430.1980 Swift, William J. and Weisbrod, Burton A. "On the Monetary Value of Education's Intergeneration Effects," *Journal of Political Economy*, Vol. 73, (December 1965), 643-649.

Presents an empirical model for placing a monetary value on the influence of education in one generation upon attitudes and educational attainments in the next generation.

Rates of return are estimated from two viewpoints: the actual money expenditures and the actual expenditures on education per student plus earnings foregone.

E5430.3000 Wolfle, D. and Smith, J.G. "The Occupational Value of Education for Superior High School Graduates," *Journal of Higher Education,* (April 1956), 201-213.

The summary results are reprinted in No. 159, pp. 178-179; median salaries of a group of students from three states in 1933-1938 rose with more college education even after adjustments were made for differences in ability, school performance, and father's occupation. (M. Blaug)

E5700.0900 Goode, R., "Educational Expenditures and the Income Tax," *Economics of Higher Education,* ed. S.J. Mushkin. Washington, D.C. Government Printing Office, p. 281-305.

A radical proposal to change the tax treatment of education by allowing the student to write off the cost of education against his future taxable income over a period of years. (M. Blaug)

NATIONAL EDUCATION PLANS

E6000.0100 Blaug, M. *Annotated Bibliography on the Role of Education in the Transition from Subsistence to Cash Economies in Middle Africa, South and South-East Asia.* Paris, UNESCO, 1965.

This bibliography covers the literature in English that explores the role of education in encouraging the indigenous population of Africa and Asia to seek wage employment and to sell produce to the market. It is broken down into six sections: measurement of the subsistence economy; case studies of subsistence economies in transition; social change and the impact of cash economies; empirical evidence of educational standards in the cash economy; the role of formal education in the transition; and the role of informal education in the transition. (M. Blaug)

E6000.0200 Komoski, P.K. and Green, E.J. *Programmed Instruction in West Africa and the Arab States.* Educ. Studies & Docs., No. 52. Paris, UNESCO, 1964.

A report on workshops in programmed instruction conducted in Jordan and Nigeria. The pamphlet is introduced with a note on programmed instruction by W. Schramm. (M. Blaug)

E6000.0300 Vogelnik, D. "A Comparison Between the Financing of Higher Education in the U.S.A. and Yugoslavia," *Economic Aspects of Higher Education,* ed. S.E. Harris. Paris, Organization for Economic Cooperation and Development, 1964, p. 117-133.

The bulk of this article is devoted to the U.S.A., leaving only a few pages for a description of educational finance in Yugoslavia. (M. Blaug)

E6000.0400 Williams, T.D. "Educational Development in Ghana and Guatemala: Some Problems in Estimating 'Levels of Educational Growth'," *Comparative Education Review,* Vol. 10 (October 1966), 462-469.

Drawing on material from Ghana and Guatemala, this article suggests that the ranking of countries adopted by Harbison and Myers into four levels of development may depend very heavily on the time the data is collected and may therefore give misleading information, particularly since their index is used for purposes of long range planning. (M. Blaug)

Africa

E6100.0100 Balogh, Thomas. "The Problem of Education in Africa," *The Centennial Review,* Vol. VI, No. 4 (Fall 1962), 526-552.

Writing in the context of Africa, the author stresses the need for educational planning to take place in close relation to planned economic and social development, or face the danger in the competition for scarce development resources, that over-ambitious or wrongly oriented educational plans will in fact impair the development effort. He denigrates the UNESCO Addis Ababa plan on these grounds, and instead proposes an African educational programme more closely related to specific African needs, e.g. education to facilitate agricultural development.

E6100.0120 Bertelsen, P.H. "Folk High Schools for West Africa," *International Development Review,* Vol. III, No. 3 (October 1961), 28-31.

A brief review of the work of the Danish folk high schools suggesting the possible useful results of their adaption to other developing countries.

E6100.0140 Blaug, M. *The Role of Education in Enlarging the Exchange Economy in Middle Africa: The English Speaking Countries.* Paris, UNESCO, 1965.

The purpose of this study is to investigate the role of education in the transformation of an economy based on self-sufficient subsistence agriculture to an economy based on market transactions, with particular reference to the English-speaking countries of Africa south of the Sahara and north of the Republic of South Africa. It analyzes the nature of the problem, reviews the existing evidence, particularly quantitative evidence, proposes future research to fill the gaps in current knowledge, and concludes with a few policy proposals based on what we now know about the interrelationship between education and economic development in an African context. The role of formal education is carefully distinguished from the role of informal education (literacy campaigns, agricultural extension, community development, and the like.) (M. Blaug)

E6100.0160 Brand, W. "The Financing of Education," *Conference of African States on the Development of Education in Africa.* Final Report. Addis Ababa, UNESCO, 1961, 31-45.

Brief general discussion of educational costs by way of an estimate for Middle Africa. (M. Blaug)

E6100.0180 Brembeck, Cole S. and Keith, John P. *Education in Emerging Africa. A Select and Annotated Bibliography.* Michigan State University, n.d.

Contains sections of 'Education and Change' and 'Educational Planning'.

E6100.0200 Busia, K.A. "Education and Social Mobility in Economically Underdeveloped Countries," *Transactions of the Third World Congress of Sociology.* London, International Sociological Association, 1956, V, 81-83.

Reviews findings to date of the relationship between education and economic development in Africa. (M. Blaug)

E6100.0220 Carter, J.R. *The Legal Framework of Educational Planning and Administration in East Africa.* African Research Monographs No. 7. Paris, UNESCO/IIEP, 1966.

This brief monograph throws light on a dark corner of educational planning: the legal and administrative framework for implementing educational plans with particular reference to the delicate balance between central and local, public and private decision-making. (M. Blaug)

E6100.0240 Cash, W.C. "A Critique of Manpower Planning and Educational Change in Africa," *Economic Development and Cultural Change,* Chicago, University of Chicago Press, October 1965, p. 33-48.

A penetrating critique of the assumptions of manpower-forecasting methods of the Harbison-type and a sketch of an alternative cost-benefit approach to educational planning in Africa. (M. Blaug)

E6100.0260 Couch, M., ed. *Education in Africa: A Select Bibliography. Pt. I: British and Former British Territories.* University of London, Institute of Education Libraries. Bulletin Supplement 5, 1962.

The most comprehensive bibliography available for English-speaking Africa, classified by countries, years of publication, and types of education. A forthcoming Pt. II will deal with French-speaking Africa. (M. Blaug)

E6100.0280 Commission for Technical Cooperation in Africa South of the Sahara. *Inter-African Conference on Industrial, Commercial and Agricultural Education,* CCTA/CSA, 1957.

Basic information on the administration of rural education in countries that are members of the Commission for Technical Cooperation in Africa South of the Sahara. (M. Blaug)

E6100.0300 Deble, I. "Les Rendements Scolaires dans les pays d'Afrique d'expression francaise," *Tiers-Monde. Problemes des Pays Sous-Developpes, Etudes,* (1964), 53-105.

A contribution to the methodology of educational planning in poor countries, illustrated with reference to a sample of schools in the Republics of Mali and the Ivory Coast. (M. Blaug)

E6100.0320 East African Institute of Social Research. *Proceedings of the EAISR Conference, January 1963, Part B., Education Research Papers.* Kampala, EAISR, 1963.

The studies comprising this set of papers include sociological and educational data relevant to effective educational planning for African countries.

E6100.0340 East African Institute of Social Research. *Proceedings of the EAISR Conference, June 1963, Part F, Education Research.* Kampala, EAISR, 1963.

The studies comprising this set of papers provide educational information of relevance to the educational planner, both at the macro- and micro-levels.

E6100.0360 Evans, P.C.C. "Western Education and Rural Productivity in Tropical Africa," *Africa,* (October 1962), 313-323.

A thorough refutation of the oft-repeated charge that Western-type schooling in Africa is inherently anti-rural and some positive recommendations for infusing a rural idiom into African education. (M. Blaug)

E6100.0380 Food and Agricultural Organization. *African Survey. Report on the Possibilities of African Rural Development in Relation to Economic and Social Growth.* Rome, F.A.O., 1962.

This authoritative report is highly critical of the state of agricultural education in Tropical Africa and submits a set of recommendations to improve it. (M. Blaug)

E6100.0400 Foster, P.J. "The Vocational School Fallacy in Development Planning," *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

An attack on the notion that educational planning in poor countries should emphasize expansion of vocational schools at the expense of schools offering a more general education. Illustrating his argument with the case of Ghana, the author concludes with some practical suggestions for improving agricultural education. (M. Blaug)

E6100.0420 Glignet, R. "Education et Aspirations Professionnelles," *Tiers-Monde. Problemes des Pays Sous-Developpes,* (janvier-mars 1964), 61-83.

A discussion of the influence of education on professional aspirations in underdeveloped countries, based on some sample surveys taken in French West Africa. (M. Blaug)

E6100.0440 Groomes, Gwendolyn. *Inventory of American Aid to Education in Africa.* Washington, D.C., American Council on Education, October 1962.

A detailed inventory of U.S. aid to African education, including data on individual projects in particular countries.

E6100.0460 Hallak, J. and Poignant, R. *Les Aspects Financiers de l'Enseignement dans les Pays Africains d'Expression Francaise.* Monographies Africaines No. 3. Paris, UNESCO/IIEP, 1966.

A useful description of the structure of educational finance in 14 French-speaking African countries. No significant relation was found in 1961 between public expenditures on education and G.D.P. per head across the 14 countries. (M. Blaug)

E6100.0480 Harbison, F.H. "The Process of Educational Planning," *Conference of African States on the Development of Education in Africa. Addis Ababa 15-25 May 1961. Final report.* Annexes, 47-54 (UNESCO/ED/181). Paris, UNESCO, n.d.

Remarks on the place of education in a modernizing society, some critical shortcomings of most current education in Africa, the process of educational planning in close relation to the occupational needs of a developing economy, and proposals for implementation and evaluation of plans.

E6100.0500 Hopkins, P.G.H. "The Role of Adult Education in Economic Development," *Economic Development in Africa,* ed. E.F. Jackson. Oxford, Basil Blackwell, 1965, 51-71.

After ridiculing rate-of-return analysis of education and repudiating any and all economic criteria for assessing educational expenditures, the author concludes: "Even if we cannot assign 'notional monetary values', we can declare confidently that 'adult education pays dividends' and big ones; and that it must be given high priority by any nation interested in its economic, social and political development." (M. Blaug)

E6100.0520 Hopkins, P.G.H. *What Role Should Adult Education Play in the Process of Economic Development?* Nyasaland, Nyasaland Economic Symposium, July 1962.

An illuminating discussion of the importance, nature, content and economic benefits of adult education, with particular reference to African conditions.

E6100.0540 Hunter, G. *Education For A Developing Region. A Study in East Africa.* London, George Allen & Unwin, 1963.

A brilliant informed contribution to educational planning in Africa. Ostensibly designed to forecast the supply of overseas students in the coming years, it reviews the facts and sketches in the likely expansion of education in East Africa in the next ten years. (M. Blaug)

E6100.0560 Institut d'Etude du Developpement Economique et Social. *Role de l'Education dans le Passage de l'Economie de Subsistance a l'Economie de Marche: l'Afrique Tropicale d'Expression Francaise.* Preparee par l'Institut d'Etude du Developpement Economique et Social de l'Universite de Paris, sous la Direction de Le Than Khoi. Paris, UNESCO, 1965.

This annotated bibliography covers the relevant literature in French and is divided into five sections: general surveys; society and traditional education; the development and effects of economy; the development and problems of education; education and economic and social development. (M. Blaug)

E6100.0580 Institut d'Etude du Developpement Economique et Social. *Problemes de Planification de l'Education.* Paris, Notes sur les conditions d'application des recommandations de la conference d'Addis-Ababa.) IEDES, n.d.

Part 1 casts doubt on the cost figures and adequacy of means for financing them assumed in the Addis Ababa Plan, and then dwells on the importance of qualitative improvements in education as a way to expand the output of the educational system, ending by including these considerations in its approach to educational planning. Part 2 is a more detailed discussion of the evaluation of the yield of the educational system in Africa.

E6100.0600 L'Institut d'Etude du Developpement Economique et Social. *Le Role de L'Education dans le Passage de l'Economie de Subsistance a l'Economie de Marche: L'Afrique Tropicale d'Expression Francaise.* Paris, UNESCO, 1965.

This study, directed by L.T. Khoi, forms a companion piece to M. Blaug's *The Role of Education in Enlarging the Exchange Economy in Middle Africa: The English Speaking Countries.* Paris, UNESCO, 1965. After a description of the subsistence economies and educational systems of French-speaking Africa, the author demonstrates statistically that enrollment ratios are directly related to the degree of 'commercialization'. He concludes, however, that education has had no significant influence on economic growth in French Africa. The last third of the monograph deals with the potential role of informal education in the transition to an exchange economy. (M. Blaug)

E6100.0620 International African Institute, under direction of D. Forde. *Select Annotated Bibliography of Tropical Africa.* New York, Twentieth Century Fund, 1956.

One section in this well-known annotated bibliography deals specifically with education. (M. Blaug)

E6100.0640 Jones, T.J., ed. *Education in Africa: A Study of West, South, and Equatorial Africa, by the African Education Commission, Under Auspices of the Phelps-Stokes Fund.* New York, Phelps-Stokes Fund, 1922.

The first comprehensive investigation of Africa's educational problems, emphasizing the need for agricultural education of the sort offered by Negro Schools in the American South. For an appreciation of the historical impact of this Report - see J.J. Shields, Jr., *The Reports of the Phelps-Stokes Fund on Education in Africa and the Formation of a Theory of Community Development by the British.* Phelps-Stokes Fund Occasional Papers, No. 4, New York: PSF, 1961, 10pp. (M. Blaug)

E6100.0660 Jones, T.J., ed. *Education in East Africa: A Study of East, Central and South Africa by the Second African Education Commission Under Auspices of the Phelps-Stokes Fund.* New York, Phelps-Stokes Fund, 1925.

A concern for rural education marks the second Phelps-Stokes Report as it did the first. Parts of this book and of the previous volume are conveniently reprinted in *Phelps-Stokes Reports on Education in Africa,* ed. L.J. Lewis. London: Oxford University Press, 1962, 213pp. (M. Blaug)

E6100.0680 Kitchen, Helen, ed. *The Educated African.* New York, Praeger, 1962.

This book briefly surveys the development of education in each of the countries of Africa, in particular examining the influences which governed that development in each country.

E6100.0700 Lewis, L.J. *Evaluation of Educational Planning in Africa.* Berlin, Deutsche Stitfung fur Entwicklungslander, 1963.

The author reviews exercises in educational planning which have taken place in Africa and suggests further problems which such planning must take into account.

E6100.0720 Lewis, W.A. "Education and Economic Development," *International Social Science*

Journal, Vol. XIV, No. 4, 1962, 685-700, also in *Policy Conference on Economic Growth and Investment in Education, III: The Challenge of Aid to Newly Developing Countries,* Paris, OECD, 1962, p. 35-49, and reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, M.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

Reviews problems of education in Africa and expresses an algebraic measure of absorptive capacity with respect to secondary education. Concludes with cogent observations on realistic educational planning in Africa. (M. Blaug)

E6100.0740 Michigan State University, College of Education. *Education in Emerging Africa. A Select and Annotated Bibliography.* Michigan State University, College of Education, 1961.

This is the first annotated bibliography devoted exclusively to education in Africa. Unfortunately, it follows no consistent principle of annotation: the content of the items cited is advertised rather than summarized, usually in the language of the relevant author. Standard canons of bibliography are violated on almost every page. (M. Blaug)

E6100.0760 Mitchell, M.B., "Comments on the Use of New Techniques in Teaching," *Conference of African States on the Development of Education in Africa. Addis Ababa, Final Report. 15-25 May 1961.* Paris, UNESCO, n.d.

The title is self-explanatory. Includes programmed learning, films, television, and other modern communications devices, with comments on their relevance to African conditions.

E6100.0780 Netherlands Economic Institute. *The Financing of Higher Education in Africa.* Paris, UNESCO, 29 June 1962.

Studies of costs of higher education in Africa, and methods of arriving at figures, and a specimen study of cost and space requirements for an African University.

E6100.0800 Shields, J.J., Jr. *A Selected Bibliography on Education in East Africa, 1941-1961.* Makerere Library Publications, No. 2. Kampala, Uganda, Makerere University College, 1962.

This supplements other bibliographies and is particularly strong on official publications and articles in East African journals. (M. Blaug)

E6100.0820 Thompson, V. and Adloff, R. *The Emerging States of French Equatorial Africa.* London, Oxford University Press, 1960.

A survey of rural problems and a review of educational developments in the republics of Chad, Central Africa, Gabon, and the Congo (Brazzaville), with a comprehensive bibliography. (M. Blaug)

E6100.0840 United Nations Economic, Scientific and Cultural Organization. *Conference of African States on the Development of Education in Africa.* Final Report, Addis Ababa, UNESCO, 1961.

A general review of educational problems, culminating in a series of resolutions. See, in particular, F.H. Harbison, "The Process of Educational Planning", pp. 47-54, a brilliant little manual of educational planning. (M. Blaug)

E6100.0860 United Nations Economic, Scientific and Cultural Organization. *Conference of African States on the Development of Education in Africa. Outline of a Plan for African Educational Development.* Addis Ababa, UNESCO, 1961.

The Conference adopted a short-term plan for 1961-1966, a long-term plan for 1961-1980, and made various recommendations designed to achieve the proposed targets. (M. Blaug)

E6100.0880 United Nations Economic, Scientific and Cultural Organization-Economic Commission for Africa (U.N.). *Conference of African States on the Development of Education in Africa, Addis Ababa, 15-25 May 1961–Final Report.* Paris, UNESCO, no date. (Also published in French.)

After general comments on various aspects of African education, the report outlines a plan for African educational development. Annex IV includes papers on educational planning and the relation of education to development, among other subjects.

E6100.0900 United Nations Economic, Scientific and Cultural Organization. *Current Educational Budgeting in Relation to the Goals of Addis Ababa.* Paris, UNESCO, 23 March 1962. UNESCO/ED/MIN/IV). (Distribution limited) (Also in French.)

Current expenditure on education in relation to the requirements in each participating country if the Addis Ababa Plan is to be fulfilled.

E6100.0920 United Nations Economic, Scientific and Cultural Organization. *The Development of Higher Education in Africa.* Paris, UNESCO, 1963.

The conference was a complement to the 1961 Addis Ababa Conference, and this is reflected in its report. The background papers include a useful compendium of statistics and information on the financing of African higher education.

E6100.0940 United Nations Economic Commission for Africa. *Economic Bulletin for Africa, II, 2, June 1962.* Addis Ababa, Ethiopia, UNECA, 1962.

A rapid but incisive discussion of what we know about the contribution of education and other social services to economic development. (M. Blaug)

E6100.0960 United Nations Economic, Scientific and Cultural Organization–Economic Commission for Africa. (U.N.). *Meeting of Ministers of Education of African Countries Participating in the Implementation of the Addis Ababa Plan–Final Report.* Paris, UNESCO, 26-30 March 1962. (Also published in French.)

Annex IX is useful for its review of the educational activities in African states in relation to the demands of the Addis Ababa plan. In a few of these countries there was a fully coordinated overall educational plan at the time of writing.

Annex X compares the existing state of educational finance and enrollment with that required for the planned fulfillment of Addis Ababa, indicating the gaps to be covered.

E6100.0980 United Nations Educational, Scientific and Cultural Organization. *National Plans for Educational Development in the General Context of Economic and Social Development.* Paris, UNESCO, 2 March 1962.

An account of the activities in educational planning which had been undertaken by various African countries by the time of the Meeting of Ministers of Education of African Countries participating in the implementation of the Addis Ababa Plan.

E6100.1000 Van Waeyenberghe-Carton, R.E. *Etudes Complementaires.* Planification de l'Enseignement. Republique du Niger, 1962.

Pages 70-98 give a review of the supply and demand for teaching personnel, with proposals for reforms, qualitative and quantitative, to enable supply to meet demand in relation to fulfillment of the targets proposed by the Addis Ababa plan.

Cameroun

E6101.0500 United Nations Educational, Scientific and Cultural Organization. *Report of the Advisory Commission for the Development of Higher Education in the Federal Republic of Cameroun.* Paris, UNESCO, 15 October 1962.

The Commission's Report attempts to compare the anticipated demand for high-level manpower with the projected enrollments in higher education, as a basis for recommending the number of higher educational establishments to be set up. The tentative nature of the results is, however, emphasized in view of the scarcity of essential data on which to base them.

E6101.0600 United Nations Educational, Scientific and Cultural Organization. *Camerounian Education Planning Group.* Report drawn up on return of the first mission, 10 March - 20 May 1962. Paris, UNESCO, 30 October 1962.

Essentially a fact-finding mission, to obtain a basis of knowledge for the subsequent formulation of educational plans. Also contains suggestions for planning aims, and recommendations for further preparatory work to facilitate educational planning in Cameroun.

Congo

E6102.0500 Pons, V.G., Xydias, N. and Clement, P. "Social Effects of Urbanization in Stanleyville, Belgian Congo," *Social Implications of Industrialization in Africa South of the Sahara.* Prepared by the International African Institute. Paris, UNESCO, (1956), 229-274.

This outstanding article reviews the educational standards, occupational distribution, employment histories, and aspirational goals of a random sample of African males in Stanleyville. It is a prime example of a large literature on social surveys in Africa. A precis of the findings is to be found in Kimble, G., *Tropical Africa, II. Society and Polity.* New York: The Twentieth Century Fund, 1960, pp. 82-88. (M. Blaug)

E6102.0600 Wolff, Jurgen H. *Bildungsprogrammierung in Entwicklungs Landern, Dargestellt am Beispiel des Kongo (Kinshasa).* Arnold Bergstraesser Institut, to be published.

Dahomey

E6103.0500 Delprat, R. "Fermes–Ecoles au Dahomey," *Developpement et Civilisations,* No. 2 (juin 1960), 59-64.

A brief account of experimental programmes in Dahomey intended to use educational activities in agricultural development.

E6103.0600 Lanhounmey, J.Q. "La Planification de l'Education au Dahomey," *Tiers-Monde. Problemes des Pays Sous-Developpes.* (avril-juin, 1965), 405-421.

An analysis of a recent educational plan for Dahomey. (M. Blaug)

Ethiopia

E6104.0100 Ethiopia, Ministry of Education and Fine Arts. *Proposed Plan for the Development of Education in Ethiopia.* Addis Ababa, Ministry of Education and Fine Arts, August 1961. (Classified limited).

An application of the plan framework of the Addis Ababa Conference of May 1961, to the Ethiopian educational system. Since the Ethiopian system is admitted to be below the African average, the reservations which have since arisen about the Addis Ababa plan would seem to apply with even greater force to this plan.

E6104.0500 United Nations Economic, Scientific and Cultural Organization. *Report on Investment in Education in Ethiopia.* Paris, UNESCO, March 1963. (Classified). (Educational Programming Investment Mission No. 14).

The Report reviews the situation of education in Ethiopia, and the educational provisions of the Second Five-Year Development Plan, 1962-1967. It is shown that these provisions cannot satisfy the Plan's manpower requirements, particularly from the secondary and primary education levels. There follows a discussion of measures of educational reform to overcome these shortcomings. There is no discussion of educational planning as such.

Gabon

E6105.0500 Proust, J. *Essai d'Analyse des Mouvements d'Effectifs Dans l'Enseignement du ler Degre au Gabon.* Paris, Institut d'Etude du Developpement Economique et Social, decembre 1962.

An examination of wastage in the educational system, with a suggestion of causes and possible solutions. The conclusion is that in Gabonese primary education qualitative rather than quantitative shortcomings are now the more important.

Ghana

E6106.0200 Darkwa, K. Ampom. "Education for Cultural Integrity. The Ghanaian Case" *Teachers College Record.* Vol. 64, No. 2 (November 1962), 106-11.

The article shows the harmful consequences which can arise from educational expansion which is unplanned in relation to current and desired economic and social development, and then goes on to discuss the problem of choosing languages of instruction.

E6106.0500 Foster, P.J. *Education and Social Change in Ghana.* London, Routledge, 1965.

A study of the impact of education on social and economic change in Ghana. The first half of the book is devoted to the history of Ghanaian education in the colonial period; the second half deals with the contemporary scene and includes the results of social surveys of secondary school pupils conducted by the author. The book is highly provocative and attacks a number of current myths about the relationship between educational and economic development. (M. Blaug)

E6106.1000 Williams, T.D. "Some Economic Implications of the Educational Explosion in Ghana," *The Education Explosion. World Year Book of Education 1965.* eds. G.Z.F. Bereday and J.A. Lauwerys. London, Evans Bros., (1965), 479-495.

Contains, among other things, an interesting skeptical discussion of the tendency of Ghanian education to produce unemployable school leavers. (M. Blaug)

Haute-Volta

E6107.0500 Medard, R. "La Scolarisation en Haute-Volta," *Tiers-Monde,* (janvier-juin 1960). Tome 1, Nos. 1-2, 234-41.

Describes the factors taken into account–demographic, economic, manpower, and financial–in evolving a programme for mass primary education in Haute-Volta adapted to the country's development needs.

E6107.0800 United Nations Educational, Scientific *and Cultural Organization. Situation et Perspectives de l'Enseignement en Haute-Volta.* Paris, UNESCO, 10 Novembre 1961.

Not an educational plan, but a review of existing education system, followed by survey of manpower resources and requirements. Then outlines programmes of expansion in relation to three alternative hypothetical targets to be achieved by 1980, i.e. over a 20-year period. The ability to finance these programmes seems not to be considered. Recommendations on educational expansion and its administration.

Ivory Coast

E6108.0200 Cerych, L. *L'aide Exterieure et la Planification de l'Education en Cote-d'Ivoire.* African Research Monograph. Paris, International Institute for Educational Planning, May 1967.

E6108.0300 Clignet, R. and Foster, P.J. *The Fortunate Few: A Study of Secondary Schools and Students in the Ivory Coast.* Chicago, Ill., Northwestern University Press, 1966.

An extension of Foster's work on Ghana to a French-speaking country. The book examines the pattern of recruitment into secondary schools, analyzes students' job expectations and examines the relation between the output of secondary schools and demand in the labor market. This book takes its place beside Foster's study of Ghana as a major contribution to our knowledge of the social and economic functions of formal education in Tropical Africa. (M. Blaug)

E6108.0400 Hallak, J. and Poignant, R. *Les Aspects Financiers de l'Education en Cote d'Ivoire.* Monographies Africaines No. 8. Paris, UNESCO, International Institute of Educational Planning, 1966.

This monograph gives further details of the structure of educational finance in one French-speaking African nation. (M. Blaug)

E6108.0800 United Nations Educational, Scientific and Cultural Organization. *Premiere Mission du Groupe de Planification de l'Education en Cote d'Ivoire. Rapport de Synthese.* Paris, UNESCO, 14 juin 1963.

The report reviews the various sectors and aspects of the national education system, in particular pointing out their favourable and unfavourable elements. Qualitative and quantitative changes needed to enable the educational system to make a maximum contribution to economic development during a Plan period from 1964 to 1980 are then discussed, together with proposals for administrative changes including the formation of an educational planning commission.

Kenya

E6109.0200 Goldthorpe, J.E. *An African Elite. Makerere College Students 1922-1960.* Nairobi, Oxford University Press, 1965.

Preliminary results of this study appeared some years ago. The work offers a short account of the history of Makerere College itself within the context of the development of education in East Africa, followed by a detailed study of the origins of Makerere students in respect of tribe, parents' literacy, kinsmen's education, kinsmen's occupation, and other aspects of family backgrounds. The most interesting part of the book, however, deals with the career experiences of Makerere graduates, including their earnings in the fifties and early sixties. (M. Blaug)

E6109.0500 International Bank for Reconstruction and Development. *The Economic Development of Kenya.* Report by the IBRD. Baltimore, The Johns Hopkins Press, 1962.

As is usual with IBRD economic survey missions, the chapter on education is a valuable review of educational problems in relation to manpower needs. (M. Blaug)

Libya

E6110.0500 International Bank for Reconstruction and Development. *The Economic Development of Libya.* Report by the IBRD. Baltimore, The Johns Hopkins Press, 1960.

An educational plan for the 1960's. (M. Blaug)

Nigeria

E6111.0100 Ashby, Sir E., Chairman. *Investment in Education. The Report of the Commission on Post-School Certificate and Higher Education in Nigeria.* Nigeria, Federal Ministry of Education, 1960.

F.H. Harbison contributes a survey of high-level manpower needs in Nigeria and projects an educational plan to fulfill these needs by 1980. (M. Blaug)

E6111.0200 Awokoya, S.O. *Educational Planning in Nigeria.* Berlin, Deutsche Stiftung fur Entwicklingslander, 1963.

An account of specific problems to be dealt with by educational planning in Nigeria.

E6111.0260 Bowles, S.S. *The Efficient Allocation of Resources in Education: A Planning Model with Application to Northern Nigeria.* Doctoral Dissertation submitted to Harvard University, 1965.

A linear programming model of the educational system, solved with data drawn from Northern Nigeria. Chapter 1 reviews the manpower planning literature. Chapter 2 presents a simplified example of an appropriate linear programming model without side constraints. Chapter 3 introduces some constraints and illustrates the method of solving the model for optimum values. Chapter 4 describes the educational system of Northern Nigeria. The production function of education is discussed and estimated for Northern Nigeria in chapter 5. Chapter 6 reviews data on the occupational distribution of the educated labor force and the findings of education-earnings surveys carried out by the author in Northern Nigeria. Chapter 7, the heart of the work, explores the economic implications of a number of alternative patterns of educational development in the model in question, and applies sensitivity analysis to the various assumptions underlying the model. The last chapter, chapter 8, suggests some extensions of the model for further work. A comprehensive bibliography caps the study. (M. Blaug)

E6111.0300 Callaway, A.C. "School Leavers in Nigeria," *The Nigerian Political Scene,* eds. R.O. Tilman and R.T. Cole. Durham, N.C., Duke University Press, 1962, 220-238.

A constructive analysis of the problems created by a surplus of primary school leavers in Eastern and Western Nigeria. Urges creation of village-level agricultural plans designed to train and integrate young farmers into the village agricultural economy. (M. Blaug)

E6111.0320 Callaway, A. and Musone, A. *Financing of Education Nigeria.* African Research Monograph. Paris, International Institute for Educational Planning, in preparation.

E6111.0340 Cerych, L. *The Integration of External Assistance with Educational Planning in Nigeria.* African Research Monograph, Paris, International Institute for Educational Planning, n.d.

E6111.0400 Harbison, F.H. "Human Resources and Economic Development in Nigeria," *The Nigerian Political Scene,* ed. R.O. Tilman and T. Cole. Durham, N.C., Duke University Press, 1962, 198-220.

A succinct discussion of the agenda for educational expansion in Nigeria. This volume also contains an annotated bibliography of materials on Nigerian education since 1957, pp. 311-315; for the earlier years, see the bibliography in J. Coleman, *Nigeria: Background to Nationalism.* Berkeley, Calif., University of California Press, 1958. (M. Blaug)

E6111.0460 International Bank for Reconstruction and Development. *The Economic Development of Nigeria.* Report by the IBRD. Baltimore, The Johns Hopkins Press, 1955.

A plan for educational expansion related to a general plan for economic development in Nigeria. Contains a good description of the Nigerian educational system. (M. Blaug)

E6111.0500 Nigeria. *Educational Development in Nigeria 1961-1970.* Lagos, Federal Government Printer, March 1961.

The Archer Report: the Report is subtitled 'A Report on the Phasing and Cost of Educational Development on the Basis of the Ashby Commission's Report on Post-School Certificate and Higher Education in Nigeria'. However, as is necessary, it makes proposals for the integrated development of the whole educational system. An associated reading of the Ashby Report can give an indication of the economic reasoning behind the educational proposals.

E6111.0520 Nigeria. Federal Ministry of Education. *Investment in Education.* The Report of the Commission on Post-School Certificate and Higher Education in Nigeria. Lagos, Federal Government Printer, 1960.

A pioneering effort in relating educational expansion to economic development needs. Part 1 is the general report; Part 2 contains a series of special reports on important particular aspects of educational expansion. Particularly important is Harbison's manpower survey. The perspective is long-term up to 1980.

E6111.0600 Okigbo, P.N.C. "Criteria for Public Expenditure on Education," *International Economic Association Conference on the Economics of Education.* London, Macmillan, 1965.

After a rapid review of the difficulties in cost-benefit analysis applied to African countries, the author turns to the Correa-Tinbergen approach and illustrates its application to Nigerian data. (M. Blaug)

E6111.0700 Thornley, J.F. *The Planning of Primary Education in Northern Nigeria.* African Research Monographs No. 2. Paris, UNESCO/IIEP, 1966.

A detailed account of the administrative problems raised by the growth of primary education in Nigeria, with particular emphasis on cost analysis of educational programs. (M. Blaug)

E6111.1000 Yesufu, T.M. *Manpower and Economic Development in Nigeria.* Cairo, Institute of National Planning, January 1962.

The author briefly shows the importance of manpower development for the Nigerian economy, and mentions some educational initiatives undertaken to further this development.

E6111.1100 Wheeler, A.C.R. *The Organizations of Educational Planning in Nigeria.* African Research Monograph. Paris, International Institute for Educational Planning, in preparation.

Senegal

E6112.0400 Fougeyrollas, P., Sow, F., and Valladon, F. *L'Education des Adultes au Senegal.* African Research Monograph. Paris, International Institute for Educational Planning, n.d.

E6112.0500 Guillaumont, P. *Les Depenses d'Enseignement au Senegal.* African Research Monograph. Paris, International Institute for Educational Planning, n.d.

E6112.0600 Institut de Recherche et de Formation en vue Developpement Harmonise (IFRED). *Le Senegal en Marche–le Plan de Developpement.* (Les Cahiers Africaines–No. 5.) Paris/Bruxelles, Editions Creations de Presse, n.d.

A vivid description of the planning process in Senegal, including educational planning in the context of economic planning.

E6112.0900 Senegal, Republique du. *Plan Quadriennal de Developpement, 1961.* Dakar, 1961.

Pages 131-156 give details of educational objectives, the investments necessary for their fruition, and policies to carry out these processes, all in the context of the National 4-Year Development Plan.

Somalia

E6113.0400 Grandjean, Henri. *Public Education in Somalia–Third Report.* Paris, UNESCO, 13 July 1961.

Part 1 is a review of the system of education current in Somalia. Part 2 is a discussion of the draft plan of educational expansion for the period 1960/1961-1964/1965, but it is not made clear how far this plan relates to anticipated economic progress or planning.

E6113.0800 Ruiter, R. *A Tentative Development Plan for Education in Somalia.* The Hague, Central Planning Bureau, October 1962.

On the basis of the projected economic growth of Somalia and a group of factors selected as crucial in determining enrollment rations, enrollment figures at various educational levels and the consequent cost and personnel requirements are determined, for 20-year and 5-year periods from 1960. This is an exercise in a planning methodology, and no study is made of the extent to which these plans can be carried out.

E6113.1000 United Nations Educational, Scientific and Cultural Organization. *Report of the Educational Planning Group on Their First Mission to Somalia.* Paris, UNESCO, August 1962.

The Report is notable for its graphic treatment of the need to develop an educational system adapted to the country's development needs and possibilities. This approach characterizes the detailed treatment given to technical education in later chapters. Chapters 9 and 10 deal with the needs for educational planning, research and statistics machinery, exemplified by the current lack of data which makes planning difficult.

South Africa

E6114.0400 *Education and the South African Economy.* The Second Report of the 1961 Education Panel. Johannesburg, Witwaterstrand University Press, 1966.

An argument for rapid expansion of secondary and higher education in South Africa, particularly for the non-white population, in order to maintain a 5 percent rate of economic growth. The argument is chiefly based on international comparisons of occupational and educational structure, and on an analysis of racial differences in educational attainments in South Africa. (M. Blaug)

Sudan

E6115.0100 Akrawi, Matta. "Educational Planning in a Developing Country," *International Review of Education,* (The Hague), Vol. 6 (1960), 257-84. (Summaries in French and German.)

Proposes a new educational framework, more in keeping with the needs of the Sudan, and indicates the measures needed to bring this to fruition, initially by means of a Five-Year plan. Only a preliminary exercise, and not fully worked out in relation to wider needs of planned economic development.

E6115.1000 United Nations Educational, Scientific and Cultural Organization. *Educational Investment Programming Mission–Sudan.* Paris, UNESCO, July 1963.

The Report is written against the background of the Ten Year Plan of Economic and Social Development 1961/62-1970/71, emphasizing the need for educational expansion to meet its manpower requirements. To this end the provisions of the Educational Development 1961/62-1967/68 are discussed, and its modest nature suggested. However, doubt is cast on the country's ability to finance this plan.

Tanganyika

E6116.0400 International Bank for Reconstruction and Development. *The Economic Development of Tanganyika.* Report by the IBRD. Baltimore, The Johns Hopkins Press, 1961.

An able review of Tanganyika's educational problems and a series of proposals for expanding education in the next decade. (M. Blaug)

E6116.0810 Tanganyika, Department of Education. *A Draft Five-Year Plan for African Education, 1957-1961.* Dar es-Salaam, Government Printer, 1956.

Though it makes provisions for a variety of trade and technical courses, there is no indication that these provisions have been related to any particular development pattern, nor that there is any specific agency charged with educational planning. Hence the plan is perhaps better described as a programme for educational expenditure.

E6116.1000 United Nations Educational, Scientific and Cultural Organization. *Report of UNESCO Educational Planning Mission for Tanganyika–June to October 1962.* Paris, UNESCO, 31 January 1963.

Reviews the existing educational situation in Tanganyika, stressing the primacy of the need to set up educational planning machinery. Paragraphs 109-116 and 252-259 deal in detail with the setting-up of this machinery and its functions. In general the report is notable for its attention to the planned expansion of education in relation to economic development.

Tanzania

E6117.0400 Hunter, G. *Manpower, Employment and Education in the Rural Economy of Tanzania.* African Research Monographs No. 9. Paris, UNESCO/IIEP, 1966.

This study is concerned with the bulk of the Tanzanian population, who have received either no or at best very little formal education, and their opportunities for productive employment in the rural economy. The author proposes various ways of expanding informal agricultural and vocational education so as to maximize the economic contribution of these uneducated youngsters. (M. Blaug)

E6117.0500 King, Jane. *Planning Non Formal Education in Tanzania.* African Research Monograph. Paris, International Institute for Educational Planning, April 1967.

E6117.0540 Knight, J.B. *The Costing and Financing of Educational Development in Tanzania.* African Research Monographs No. 4. Paris, UNESCO/IIEP, 1966.

A valuable contribution to cost analysis of education, illustrating the technique of projecting unit costs by major categories of expenditures throughout the educational system. (M. Blaug)

E6117.0580 Mwingira, A.C. and Pratt, S. *The Process of Educational Planning in Tanzania.* African Research Monograph. Paris, International Institute for Educational Planning, n.d.

E6117.0800 Skorov, G. *Integration of Educational and Economic Planning in Tanzania.* African Research Monographs No. 6. Paris, UNESCO/IIEP, 1966.

An excellent critical review of the three leading manpower forecasts that have been made in Tanzania in 1962, followed by a discussion of the links between these forecasts and various economic development problems. (M. Blaug)

Uganda

E6118.0200 Chesswas, J.D. *Educational Planning and Development in Uganda.* African Research Monographs No. 1. Paris, UNESCO/IIEP, 1966.

This study is mistitled: what it really deals with is educational administration and cost-accounting in Uganda. It describes the rules-of-thumb used by Ugandan planners to calculate future enrollments, capital and recurrent costs per place, staff ratios and required teacher-training facilities, and the like. (M. Blaug)

E6118.0400 El Shimy, S.A.F. *Correlating Technical Training with General Education in Africa.* Paris, UNESCO, 1963.

The author stresses the need for education to relate to environment, and shows how this fails to happen in most African education, which takes children from agricultural backgrounds and trains them for white-collar jobs. He then describes Ugandan initiative to overcome this situation, and makes some proposals for African agricultural education.

E6118.0800 Smyth, J. and Bennett, N. *The Direction of Development of Education in Uganda–the Need for High Level Manpower?"* Presented to the Conference of the East African Institute of Social Research, (January 3, 1966), 37.

Presents a rate of return analysis of the Ugandan educational system, based on official cost estimates and government salary scales for educated people. The tentative results conflict sharply with the findings of manpower forecasters. (M. Blaug)

E6118.1000 Williams, P. *Aid in Uganda–Education.* London, Overseas Development Institute, 1966.

An excellent survey of the leading issues in Ugandan educational development, emphasizing the problems of cost and finance, and a careful review of past patterns of educational aid and the potential scope of future assistance. (M. Blaug)

Zambia

E6119.1000 Republic of Zambia. *Manpower Report. A Report and Statistical Handbook on Manpower Education, Training and Zambianisation 1965-1966.* Lusaka, Government Printer, 1966.

Based on a complete survey of the Zambian labor force, this report on the manpower problems of Zambia includes forecasts for 1970 and data, the first of its kind for Africa, on annual earnings over the last decade by levels of education. (M. Blaug)

ASIA

E6200.0100 Debeauvais, M. *Determination of Objectives in the Regional Planning of Education.* Paris, Institute d'Etude du Developpement Economique et Social, 1963.

Using the Karachi Plan as an example, the author shows how, in a regional (continental) plan, the objectives must be made consistent if the plan is to be realizable. The

paper also lists the advantages of this supranational approach to planning.

E6200.0120 United Nations Economic Commission for Asia and the Far East. *Programming Techniques for Economic Development.* Bangkok, ECAFE, 1960.

A theoretical study of the planning process made by a group of U.N. experts. Chapter VIII deals specifically with manpower and educational planning.

E6200.0140 Hauser, P.M., ed. *Urbanization in Asia and the Far East. Proceedings of the Joint UN/UNESCO Seminar, Bangkok, 1956.* Tension and Technology, Paris, UNESCO, 1957.

Some data and discussion of the role of rural education in economic development. (M. Blaug)

E6200.0860 Regional Centre for the Training of Educational Planners, Administrators and Supervisors in Asia, New Delhi. *Educational Planning in Developing Countries.* New Delhi, April, 1963.

A concise and valuable introduction to all aspects of the subject of educational planning.

E6200.0880 Regional Centre for the Training of Educational Planners, Administrators and Supervisors in Asia, New Delhi. *Prospectus for the Course for Educational Planners and Administrators.* Bangkok, UNESCO, 31 August-28 November 1963.

A brief description of the conception, general programme and arrangements for the course.

E6200.0900 Solomon, E.B. and Averhan, J. *Draft Asian Education Model: Methodology and Concepts.* UNESCO Monthly Economics Seminar, September 15, 1965.

E6200.0920 Shukla, S. *The Context of Education in Developing Societies.* Delhi, Central Institute of Education, 1963.

A report of a conference which discussed educational experiences in a number of Asian countries, and attempted to relate them to development.

E6200.0940 Le Thi Nam Tran. "Les Depenses Publiques de l'Education dans les Pays du Plan Karachi," *Tiers-Monde. Problemes des Pays Sous-Developpes.* Paris, (avril-juin, 1965), 531-551.

A critical analysis of the 1960-1961 data of educational expenditures in the Karachi Plan countries. (M. Blaug)

E6200.0960 United States Agency for International Development/National Economic Council. *Far East Manpower Assessment and Educational Planning Seminar.* February 1965. Manila, Philippines, National Economic Council, Republic of the Philippines and USAID, 1965.

After a few brief introductory essays, the bulk of the volume consists of country-papers on manpower planning in China (Taiwan), Korea, Philippines, Thailand, and Vietnam. (M. Blaug)

E6200.0980 United Nations Economic, Scientific and Cultural Organization. *An Asian Model of Educational Development: Perspectives for 1965-1980.* Paris, UNESCO, 1966.

Presents projections of enrollments and output of each educational level up to 1980 for all the Karachi Plan countries, based on a mathematical model of the education system. For practical purposes the countries are divided into three groups: (1) those likely to achieve 7 years' compulsory schooling before 1980–Ceylon, China, Korea, Malaysia, Philippines, Singapore, Thailand; (2) those likely to reach this target by 1980–Burma, Cambodia, India, Indonesia, Iran, Mongolia, Pakistan, Vietnam; and (3) those likely to reach it after 1980–Afghanistan, Laos, Nepal. Estimates are made of the total costs of the projected expansion, both in absolute terms, and in relation to projected rates of growth of GNP. In all countries it is clear that the projected rates of expansion will involve increasing the proportion of GNP devoted to education. (M. Blaug)

E6200.1000 United Nations Educational, Scientific and Cultural Organization. *Economic and Educational Planning in Asia.* Bangkok, UNESCO, 7 March 1963.

Contains sections on economic development, Asian national development plans, educational planning, both in general and with specific reference to Asian countries and statistics.

E6200.1020 United Nations Educational, Scientific and Cultural Organization. *Educational Planning in Asia.* Paris, UNESCO, 6 August 1962.

Planning needs and methods in the context of the Asian situation. Discussion of planning administration.

E6200.1040 United Nations Economic, Scientific and Cultural Organization. *The Needs of Asia in Primary Education. A Plan for the Provision of Compulsory Primary Education in the Region.* Educ. Stud. & Docs. No. 41, Paris, UNESCO, 1961.

A collection of resolutions and recommendations adopted in connection with the Karachi Plan, including some regional statistical data. (M. Blaug)

E6200.1060 United Nations Educational, Scientific and Cultural Organization. *The Plan of Educational Development in Asia and Overall Educational Planning.* Paris, UNESCO, 27 February 1962.

Remarks on the implications for planning of other aspects of the educational system resulting from the operation of the Karachi Plan for universal primary education in Asia.

E6200.1080 United Nations Educational, Scientific and Cultural Organization. *Rapport Sur la Planification de l'Enseignement en Iran, en Thailande, et en Viet-nam, Dans le Cadre de la Planification Generale de Ces Trois Pays.* Paris, UNESCO, 8 mai 1961.

A description of educational planning activities in three Asian countries, in the context of their general planning.

E6200.1100 United Nations Economic, Scientific and Cultural Organization. *Report of Meeting of Ministers of Education of Asian Member States Participating in the Karachi Plan. Tokyo, April 2-11, 1962.* Bangkok, UNESCO, 1962.

A review of the progress made in implementing the Karachi Plan of 1960 for attaining compulsory free primary education by 1980 in the 17 Asian Member States. UNESCO contributed a survey of "The Economic Implications of the Plan of Educational Development in Asia", pp. 59-69, reprinted in *Readings on Education and Economic Development*, eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey. Paris: UNESCO, 1964. UNECAFE contributed a brief treatment of "Some Considerations on the Relationship of Educational Planning to Economic and Social Development in the ECAFE Region", pp. 71-76. (M. Blaug)

E6200.1120 United Nations Educational, Scientific and Cultural Organization. *Report of the Regional Seminar on Educational Statistics in Asia and Oceania.* Paris, UNESCO, 8 January 1962.

The report emphasizes the need to improve educational statistics in view of their increasing use in educational planning, and then goes on to discuss the types of statistics needed.

E6200.1140 Van der Kroef, J.J. "Asian Education and Unemployment: The Continuing Crisis," *Comparative Education Review,* New York, Vol. 7, No. 2 (October 1963), p. 173-80.

A discussion of the growing problem in Asia of the 'educated unemployed', which examines its causes and some consequences. It is concluded that solution of the problem depends on a more harmonious development of education and the economy.

Australia

E6201.0100 Australia. Parliament of the Commonwealth of Australia. *Report of the Committee on Australian Universities.* Canberra, Commonwealth Government Printer, 1958.

Although not a formal plan for expansion, this report gives a planning-minded treatment of the needs for rapid expansion of the Australian universities. It brings out the point that at the higher levels, educational expansion is a continuing heavy burden for any country, whatever its income level.

China

E6202.0200 Cartier, M. "Planification de l'Enseignement et Formation Professionelle en Chine Continentale," *Tiers-Monde. Problemes des Pays Sous-Developpes,* (avril-juin, 1965), 511-530.

A valuable review of educational policies in China since 1949. (M. Blaug)

India

E6203.0200 Cormack, Margaret L. *She Who Rides a Peacock.* New York, Praeger, 1961.

A perspective study of the reactions of Indian students to their lives in a rapidly changing society, suggesting that education must be adapted to social change, so that the influence of education on development is based on qualitative as well as quantitative considerations. Uses questionnaire method.

E6203.0400 India, Committee on Plan Projects. *Draft Report on Teacher Training.* New Delhi, Government of India, May 1963.

The Report gives an account of the present availability of teachers, both trained and untrained, and then goes on to examine the possibilities and problems of teacher education in India.

E6203.0420 India, Committee on Plan Projects. *Report on Delhi School Buildings.* New Delhi, Government of India, October 1960.

Using Delhi as an example, this brief report recognizes the enormous classroom shortage in India, and makes detailed proposals to economize in construction methods to help overcome it.

E6203.0440 India, Committee on Plan Projects. *Report on Primary School Buildings in Delhi.* New Delhi, Government of India, July 1963.

The report suggests construction standards for primary school buildings, pointing out that the shortage of these has tended to increase.

E6203.0460 India, Committee on Plan Projects. *Report on Science Laboratories and Equipment in High/Higher Secondary Schools.* New Delhi, Government of India, November 1962.

Recognizing the rapid need to educate more technical personnel to satisfy the needs of a developing country, the report makes recommendations for standard laboratory design and equipment.

E6203.0480 India, Committee on Plan Projects. *Report on Secondary School-Cum-Hostel Buildings in Rural Areas.* New Delhi, Government of India, October 1963.

Design proposals for rural schools which can also be used as hostels, suitable for areas with widely scattered school populations.

E6203.0500 India, Ministry of Education. *Draft Perspective Plan for the Development of Elementary Education in India (1961-1975).* Delhi, Government Press, 1962.

This publication sets out the consequences of adopting three alternative targets for primary educational expansion over a 15-year period, with particular emphasis on their impact on the teaching force. It is not formally a plan, but undertakes techniques of planning and produces results which would be incorporated in a plan for India at the national level. No indication is given of the relation of the targets to the development effort.

E6203.0600 India, Ministry of Labour and Employment. *Educational and Technical Training Requirements of Production Process Workers in the Cotton Textile Industry.* New Delhi, Ministry of Labour, 1961.

An interesting attempt to define the minimum and optimum educational qualification for occupations typically filled by craftsmen and operatives in the Indian cotton textile industry. Employers' opinions in five large enterprises were surveyed and compared with current hiring standards. The results are summarized on pp. 1-8. (M. Blaug)

E6203.0700 India, Planning Commission. *Second Five-Year Plan. Education and Social Services.* New Delhi, Government of India Press, 1957.

Summary of measures for educational reform being undertaken in the context of the Second Five-Year Plan. A series of programmes for education directed to assisting economic development, but not as an educational plan.

E6203.0720 India, Planning Commission. *Third Five-Year Plan: A Draft Outline.* New Delhi, Government of India Press, 1960.

The relevant pages give an outline of the educational provisions within the Third Five-Year Plan and discuss the manpower requirements to be satisfied by 1965. (M. Blaug)

E6203.0800 Kothari, V.N. "Factor Cost of Education in India," *Indian Economic Journal,* (April-June 1966), 631-647.

An estimate of the total resource cost of Indian education, including earnings foregone, for the years 1950 to 1951, 1956 to 1957 and 1959 to 1960. (M. Blaug)

E6203.0820 Leagans, J.P. *India's Experience With Training in Extension Education for Community Development.* Ford Foundation. New York, State College of Education, 1961.

A brief but comprehensive review of the work undertaken in India to train rural development personnel. (M. Blaug)

E6203.0840 Misra, A. *Educational Finance in India.* London, Asia Publishing House, 1962.

A comprehensive study of educational finance in India since 1700, with a detailed evaluation of existing practices. The book includes a valuable bibliography and a long appendix of statistics on educational finance in India. (M. Blaug)

E6203.0860 Naik, J.P. *Educational Planning in India.* Bombay, Allied Publishers, 1965.

Eight somewhat repetitious essays written on separate occasions in 1963 and 1964 on various aspects of Indian educational planning. They are addressed to the general reader but can be recommended even to specialists for their many shrewd comments. (M. Blaug)

E6203.0900 Nepal, Ministry of Education. *The Five-Year Plan for Education in Nepal.* Kathmandu, Ministry of Education, 1957.

The outline of a five-year plan for educational expansion in Nepal, made within the context of the recommendations of the National Education Planning Commission appointed in 1954. The period of operation of the plan is not made clear, though its associated University Project is scheduled to run from 1956 to 1961. The Plan is commented upon in the subsequent UNESCO Report, *'Educational Planning In Nepal and its Economic Implications,'* (1962).

E6203.0920 Neurath, Paul M. "Radio Farm Forum as a Tool of Change in Indian Villages," *Economic Development and Cultural Change,* Vol. X, No. 3 (April 1962), 275-83.

An account of an Indian initiative, adapted from Canadian experience, for the education of farmers to effect improvements in their agriculture.

E6203.0940 Pant Pitambar. *Manpower Planning and Education.* Cairo, Institute of National Planning, January 1962.

Drawing on Indian experience during the succession of five-year plans, the author illustrates the importance of manpower in development, and points out the resultant areas of choice in educational policy.

E6203.0980 Tilak, V.R.K. "The Future Manpower Situation in India, 1961-76," *International Labour Review,* Vol. LXXXVII, No. 5 (May 1963) 435-46.

Population and labor force estimates, together with the educational characteristics of new entrants, are used to establish requirements for global expansion of the Indian educational system.

E6203.1000 Wood, Hugh B. *Problems of Educational Planning in Nepal.* Berlin, Deutsche Stiftung fur Entwicklingslander, 1963.

An account of the problems faced in the preparation and implementation of educational planning in Nepal.

E6203.1020 Wood, Hugh B. and Knall, Bruno. *Educational Planning in Nepal and its Economic Implications.* Kathmandu, United Nations Economic, Scientific and Cultural Organization, May 1962. (Draft report of the UNESCO mission to Nepal, January-May 1962.)

The report surveys the programme of Nepalese educational expansion initiated in 1954, and makes recommendations for its modification in the light of economic development needs and potential and the resources available for education. Although educational planning activities were early initiated, there is a lack of research and statistics to back them up (Chapter 3, Section II). Also considers the economic planning machinery and its products as a frame for further educational planning activity, the possible extent of which is discussed in a final chapter, together with its organization.

Japan

E6204.0400 Japan Ministry of Education. *Demand and Supply for Graduates from Secondary Schools and Universities: Japan.* Tokyo, Ministry of Education, 1961.

The Methodology and results of the survey are first described and then it is explained how the results are incorporated in the educational plan.

E6204.0420 Japan, Ministry of Education. *Japan's Growth and Education. Educational Development in Relation to Socio-Economic Growth. The 1962 White Paper on Education.* Tokyo, Ministry of Education, 1963.

Estimates the stock of educational capital since 1905, measures the spread of education in Japan, reviews historical data on educational expenditures, assesses the average level of education of the labor force, and compares Japan's achievements with those of other countries. All in all, a remarkable volume and without doubt the authoritative work on Japanese education. (M. Blaug)

E6204.0440 Japan, Ministry of Education. *National Surveys of Educational Expenditures: Japan.* Tokyo, Ministry of Education, September 1961.

A description of the system of educational finance in Japan is followed by detailed accounts of the various surveys of educational expenditure which are carried out.

E6204.0500 Japanese National Commission for UNESCO. *The Role of Education in the Social and Economic Development of Japan.* Tokyo, Ministry of Education, 1966.

A historical survey of the development of education and its contribution to industrialization and economic growth in Japan since 1868. (M. Blaug)

E6204.0600 Passin, H. *Society and Education in Japan.* New York, Teachers College, Columbia University, 1965.

A development of his earlier essay, this book provides valuable background reading to more economically oriented surveys of the history of Japanese education. Half of the book consists of original documents. (M. Blaug)

Malaya

E6205.0400 International Bank for Reconstruction and Development. *The Economic Development of Malaya.* Report by the IBRD. Baltimore, The Johns Hopkins Press, 1959.

A fairly detailed description of the educational system and a development programme for the Federation and for Singapore, treated separately. (M. Blaug)

New Zealand

E6206.0500 Jacoby, E.G. *Methods of School Enrollment Projection.* Paris, UNESCO, Educational Studies and Documents No. 32, 1959.

Methodology of projecting school enrollments, based on New Zealand experience.

Pakistan

E6207.0100 Brembeck, Cole S. and Weidner, Edward W. *Education and Development in India and Pakistan.* A select and annotated bibliography. (Education in Asia Series 1.) East Lansing, Michigan, Michigan State University, n.d.

The major part of this work is concerned with different aspects of education, and in addition a number of publications closely related to educational planning are included.

E6207.0200 Curle, A. *Planning for Education in Pakistan. A Personal Case Study.* London, Tavistock Publications, 1966.

A personal account of the author's experiences as an educational advisor to the government of Pakistan. It includes material on Pakistan's educational progress and a fascinating description on how the chapter in *Guidelines for the Third Five Year Plan* came to be written. (M. Blaug)

E6207.0400 Graham, A.B., *et al. Technical Education in Pakistan.* Report of the UNESCO Mission to Pakistan, February-March 1961. Paris, UNESCO, 1961.

The Report discusses the proposals of the National Commission of Education and the Second Five-Year Plan referring to technical, commercial and agricultural education, and makes modifying recommendations in the light of further knowledge of the future economic needs of the country. The need to extend educational planning services is also mentioned.

E6207.0500 Michigan State University, College of Education. *Education and Development in India and Pakistan: A Select and Annotated Bibliography.* Michigan State University Education in Asia Series I. Michigan, College of Education, 1961.

A reading guide in the essay style. Other bibliographies are listed on pp. 174, 221. This work is less valuable than it might have been, owing to the failure to apply strict canons of bibliography. (M. Blaug)

E6207.0700 Pakistan, Ministry of Education. *Report of the Commission on National Education.* Karachi, Government of Pakistan Press, 1959.

The report represents an attempt to lay down lines of guidance for the future development of education in Pakistan. It is notable for the attention paid to education as a channel to economic development.

E6207.0800 Pakistan, National Planning Board. *The First Five-Year Plan, 1955-1960. Chapter 27. Education and Training.* Karachi, Government of Pakistan, December 1957.

The educational provisions of the first five-year plan were designed to overcome the worst shortcomings of an educational system unadapted to the needs of a developing country. As such they can hardly be said to constitute an overall educational plan, but do represent an integration of educational planning into development planning, e.g. in policies for expansion of technical training.

E6207.0900 Pakistan, Planning Commission, Education and Training. *Introduction of Universal Primary Education 1. Within 15 Years (1960-75). 11. Within 10 Years (1960-70).* Karachi, Government of Pakistan, 8 October 1959.

Outlines two alternative plans for achievement of universal primary education, dealing also with associated requirements for finance and teaching personnel.

E6207.0920 Pakistan Planning Commission. *The Second Five-Year Plan (1960-1965).* Karachi, Government of Pakistan, 1960.

Summarizes educational progress under the first five-year plan and indicates the educational targets and programmes to achieve these targets of the second five-year plan. See also *The First Five-Year Plan (1955-1960).* Karachi: Government of Pakistan, 1957, ch. 27, pp. 539-590. (M. Blaug)

E6207.0940 Pakistan, Planning Commission, Education and Training. *Statement Identifying the Tasks Set in the First Five-Year Plan, a Brief Review of progress, and the Possible Contents of the Second Plan.* Karachi, Government of Pakistan, April 1959.

A brief example of the process of evaluating the progress of a plan and making proposals in the light of this for further plans.

E6207.1000 Rashid, M. "Absorption of the Educated," *International Economic Association Conference on the Economics of Education,* London, Macmillan, 1965, p. 398-421.

This article manages to discuss the problem of graduate unemployment in Pakistan without a single reference to earnings. (M. Blaug)

Philippines

E6208.1000 Samonte, Quirico S. "Land Tenure and Public School Enrollment in the Philippines," *Comparative Education Review,* Vol. 5, No. 2 (October 1961), 136-41.

Using the example of land-tenure patterns in the Philippines, the author shows how features of the socio-cultural setting may be relevant to the concerns of educational planners, even though not obviously related to the educational system.

E6208.1500 United Nations. *Population Growth and Manpower in the Philippines.* New York, United Nations, 1960.

This study gathers together data relevant to the preparation of an educational plan for the Philippines, though only a small section (p. 27) actually deals with the educational implications of the data.

Southeast Asia

E6209.0500 Myint, H. "The Universities of Southeast Asia and Economic Development," *Pacific Affairs,* (Summer 1962), 116-128.

An illuminating analysis of the problems of higher education throughout Southeast Asia in relation to opportunities in the labor market for both secondary school and university graduates. (M. Blaug)

E6209.0540 Neff, Kenneth L. "Education and the Forces of Change," *International Development Review,* Vol. IV, No. 1 (March 1962), 22-25.

A brief examination of the inappropriateness of Southeast Asian cultures to development needs, as causes of the relative ineffectiveness of education as a development agent.

E6209.0560 Neff, K.L. *Selected Bibliography on Education in Southeast Asia.* U.S. Department of Health, Education, and Welfare. Office of Education. Washington, D.C., Government Printing Office, 1963.

A country-by-country annotated list. (M. Blaug)

E6209.1000 United Nations Economic, Scientific and Cultural Organization–International Association of Universities. *Higher Education and Development in Southeast Asia. Summary Report and Conclusions.* Paris, UNESCO, 1965.

The report by H. Hayden and the conclusions by J. Lockwood summarize the findings of a larger study to be published later surveying the present position and estimating the future needs of higher education in Burma, Cambodia, Indonesia, Laos, Malaysia, the Philippines, Thailand, and Vietnam. See, particularly, ch. 3, pp. 27-35 on 'High-Level Manpower for Development'. (M. Blaug)

Taiwan

E6210.0500 McCusker, H.F., Jr. *An Approach for Educational Planning in the Developing Countries.* Prepared for the Symposium on the Possibilities of Operations Research in Developing Countries June 26-28, 1963, Paris, France. Menlo Park, Calif., Stanford Research Institute, 1963.

An application of the Correa-Tinbergen model to the Republic of China (Taiwan) and a comparison of its results with those obtained from manpower forecasts. (M. Blaug)

E6210.0520 McCusker, Henry F. and Robinson, Harry J. *Educational Development: the Role of Educational Planning in the Economic Development of the Republic of China.* Menlo Park, California, Stanford Research Institute, October 1962.

A study of the educational system and manpower requirements in Taiwan, with suggestions for bringing the two together.

Thailand

E6211.0400 International Bank for Reconstruction and Development. *A Public Development Program for Thailand.* Report by the IBRD. Baltimore, The Johns Hopkins Press, 1959.

A rapid review of educational problems in Thailand and a costed development programme. (M. Blaug)

E6211.0500 Joint Thai-USOM Human Resources Study. *Preliminary Assessment of Education and Human Resources in Thailand.* Report of the Joint Task Force, Vol. II. Working Paper. USOM/THAILAND, Agency for International Development, October 1963.

Volume I reviews the educational system and indicates its likely shortcomings in relation to probable manpower needs, using the situation revealed as a basis for proposed educational changes. The impact of these on the planning and administrative services is then considered. Volume II contains a series of Working Papers on aspects of the manpower and educational situations, which formed the basis for the conclusions reached in the report.

E6211.0800 Thailand. Research Committee on Secondary Education and Human Resource Development in Thailand, Educational Planning Office. *Current and Projected Secondary Education Programs for Thailand; A Manpower and Educational Development Planning Project.* Bangkok, Thailand, 1966.

E6211.0900 Thailand. Educational Planning Office, Ministry of Education. *Report on the Budget*

Analyses 1960-1964 of the Ministry of Education. Bangkok, Thailand, 1963.

E6211.1000 United Nations Economic, Scientific and Cultural Organization. *Educational Investment Programming Mission–Thailand.* Paris, UNESCO, December 1963.

The Report of the Mission takes into account the economic and manpower backgrounds in evaluating the current educational situation, on the basis of which it suggests projects for educational investment, with details of their anticipated cost.

Vietnam

E6212.0400 Knall, Bruno and van Waeyenberghe, Remi. *La Planification de l'Education Dan Ses Rapports Avec la Planification de l'Economie.* (Report of UNESCO mission to Vietnam, October-December 1960). Saigon, United Nations Educational, Scientific and Cultural Organization, December 1960.

In the absence of economic or educational planning activities in Vietnam, the report confines itself to reviewing the progress of the educational system, commenting on its lack of adaption to development needs, and the current state of the economy. A final chapter discusses in more detail the prospects for developing planning services, with recommendations, in particular for an educational planning service.

EUROPE

E6300.0200 Bell, G. *Essai d'Approche des Problemes de Transcription des Objectifs d'un Plan d'Education a Long Terme en Objectifs a Moyen Terme.* Paris, Organization for European Cooperation and Development, 6 December 1963.

An examination of the work intermediately involved in activating a long-term educational plan, based on the OECD Mediterranean Regional Project.

E6300.0240 Diez-Hochleitner, R. "L'Importance des Facteurs Pedagogiques et Institutionnels," *Tiers-Monde,* Tome 1, Nos. 1-2 (janvier-juin 1960), 191-96.

An enumeration of factors relevant to the success of educational plans, both in their preparation, and in their implementation.

E6300.0280 Eide, Kjell. *Educational Developments in Relation to Economic Growth in OECD Member Countries.* Paper given at the International Economic Association Conference on the Economics of Education, Menthon St. Bernard, 29 August - 7 September 1963.

A description of the supply situation of highly qualified manpower in the OECD countries is followed by a review of some approaches to educational planning.

E6300.0400 Gass, J.R. and Lyons, R.F. *International Flows of Students.* Paris, Organization for Economic Cooperation and Development, 1962.

A study of movements of students between European countries for the purpose of receiving higher education, taking note of the importance of this process for the difficult task of expanding education in the poorer countries, having few resources for the purpose.

E6300.0440 Hayward, B. "The Current Efforts in the Organization for Economic Cooperation and Development Planning Programme to Project Student Inflow Into the Upper Levels of Education: Technique and Educational Policy," Paris, OECD, 1964.

A useful summary of the findings of some Dutch, Swedish and Swiss studies prepared for OECD on the general problem of projecting enrollment in higher and further education and the factors governing future enrollment. (M. Blaug)

E6300.0480 International Association of Universities. *Some Economic Aspects of Educational Development in Europe.* Paris, International Universities Bureau, 1961.

The proceedings of a conference held at Bellagio, Italy, in July 1960, containing a set of 'Background Notes' by J. Vaizey, two brief general articles on educational planning in Yugoslavia, Germany, and France. (M. Blaug)

E6300.0500 International Labour Organization. *European Apprenticeship: Effects of Educational, Social and Technical Development in Apprenticeship Training Practices for Eight Countries.* Geneva, ILO, 1966.

The eight countries are Austria, Czechoslovakia, Denmark, France, Western Germany, The Netherlands, Switzerland and the United Kingdom. This book is an encyclopedia of information on the organization of training and the finance of apprenticeship programmes in the countries concerned. (M. Blaug)

E6300.0540 Jamin, V.A. "Economics of Education," *Sovetskaya Pedagogika,* (1964), translated in *Soviet Education,* No. 1 (June 1965), 49-57.

The article describes research activities in the economics of education in the West, indicates some works forthcoming in the Soviet Union, and closes with an agenda for further research. (M. Blaug)

E6300.0600 Malassis, L. *Intellectual Investment in Agriculture for Economic and Social Development.* Organization for Economic Cooperation and Development Documentation in Agriculture and Food, No. 60. Paris, OECD, 1962.

A general discussion of the role of research, education and information in the agricultural sector with reference to educational planning in the developed countries of Europe. A useful source of data on agricultural education and extension services in various Western European Countries. (M. Blaug)

E6300.0620 Martin, V. *Accelerated Vocational Training for Adults. Manpower and Employment Studies.* Paris, Organization for Economic Cooperation and Development, 1965.

This comparative study of the methods and aims of AVT in 4 countries in Western Europe (France, Great Britain, the Netherlands, and Belgium) argues the case rather than

surveys the existing scene. The bulk of the book is devoted to a detailed discussion of AVT syllabuses and the training of AVT instructors. (M. Blaug)

E6300.0700 Organization for Economic Cooperation and Development. *Econometric Models of Education: Some Applications.* Paris, OECD, 1965.

The OECD countries have become increasingly aware of the importance of education to the attainment of their social and economic goals. As a result, long-range educational planning is becoming an integral part of national economic planning. This tendency has been facilitated by the development of new mathematical techniques of analysis. These techniques have been successfully applied to complex scientific, economic and industrial problems. They should be equally fruitful when applied to the equally complex processes of education.

The study contained in this volume is a first attempt to do so, to build a mathematical model of the educational system, based, in this case, on its relationship to economic growth. The study involved both the preparation of abstract models as well as their experimental application to particular educational systems. This experience has demonstrated the many potentialities of the mathematical model approach, and that further research is needed and warranted.

The original model, upon which this study was based, was the subject of a lecture given by Professor Jan Tinbergen at Frascati, Italy, as part of the 1962-1963 training series of the OECD Human Resource Development Fellowship Programme. An additional seminar on the model was held in December 1962 at the Netherlands Economic Institute. The Mediterranean Regional Project provided an excellent opportunity to test the model. The first stage of the MRP involved the preparation of national studies assessing the long-term educational needs of six Mediterranean countries: Greece, Italy, Portugal, Spain, Turkey, and Yugoslavia. Thus, data were available for applying the model. Moreover, the results of these applications could be compared with those found by more conventional methods of analysis. (Author)

E6300.0720 Organization for Economic Cooperation and Development. Joint *EIP/MRP Meeting.* Paris, OECD, 1965.

This joint meeting of OECD's Educational Investment and Planning Programme and the Mediterranean Regional Project included the following papers: L. Sandren, 'Estimates of Manpower Needs in the Light of Educational Planning in Sweden', (8pp); R. Ruiter, 'Manpower Forecasts and Educational Planning in The Netherlands', (12 pp.); M. O'Donoghue, 'The Manpower/Educational Activities of the Irish E.I.P. Team', (11 pp.) and 'The Projection of Manpower Requirements for Austria up to 1980', (59 pp.); H.S. Parnes, 'Scope and Methods of Human Resource and Educational Planning', (22 pp.); G. Bombach, 'Forecasting Requirements for Highly-Qualified Manpower as a Basis for Educational Policy', (49 pp.); the Secretariat, 'Summary of the Technical Evaluation of the M.R.P. Experience', (14 pp.); K. Eide, 'Regional Aspects of Educational Planning in Norway', (5 pp.); S.J. Mushkin, 'Education and Regional Organization in the United States', (12 pp.); P.B. Jacobson, 'Regional Aspects of School Planning in Sweden', (11 pp.); J. Binon, 'Regionalization of Educational Development in France', (11 pp.); Greek M.R.P. Team, 'Regional Aspects of Educational Planning in Greece', (8 pp.); Portuguese M.R.P. Team, 'The Importance of Regionalization in Educational Planning', (6 pp.); and the Secretariat, 'Educational Planning at the Regional Level', (7 pp.). (M. Blaug)

E6300.0740 Organization for Economic Cooperation and Development. *Organizational Implications of the Link Between Education and Economic Growth.* OECD Directorate for Scientific Affairs. Paris, OECD, 1964.

A somewhat amorphous collection of papers, including a piece by R. Poignant on 'Educational Development Plans in Economic and Social Development Programmes', chiefly with reference to France, a careful and exhaustive review of the relationship between 'Manpower Requirements and Educational Organization' by H. Goldstein, and 'Reflections on Centralization versus Decentralization in Education', illustrated by Dutch educational problems, by W. Brand. R. Gregoiro's 'Summary Report of the Discussion' provides an admirable precis of the various contributions, stressing that few current educational plans in Europe are in fact based on manpower forecasts. (M. Blaug)

E6300.0760 Organization for Economic Cooperation and Development. *Policy Conference on Economic Growth and Investment in Education, II.* Paris, OECD, 1962. Excerpts reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey, Paris, UNESCO, 1964.

The product of a team of three experts: I. Svennilson, J.L. Elvin, and F. Edding. Chs. 1 and 2 provide a general discussion of issues in educational planning. Ch. 3 serves as a useful comparison of educational attainments in various OECD countries, together with targets for 1970. (M. Blaug)

E6300.0780 Organization for Economic Cooperation and Development. *Policy Conference on Economic Growth and Investment in Education IV.* Paris, OECD, 1962.

Three papers on educational planning in Europe: R. Poignant on 'France', S. Moberg on 'Sweden', and M. Elazer on 'Yugoslavia', with valuable data on the three countries. (M. Blaug)

E6300.0800 Organization of European Economic Cooperation. Office for Scientific and Technical Personnel. *Mediterranean Regional Project–Analysis of Educational Needs and Priorities for Specialized Manpower in Relation to Economic Development.* OSTP/PD/60.66. Note on methodology by Professor Edding. Paris, 14 November 1960.

Brief exposition of the educational planning process in an economic context, especially the financial aspects, and forecasting of educational needs.

E6300.0840 Parnes, H.S. *Forecasting Educational Needs for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1962.

This volume sets forth the rationale underlying the Mediterranean Regional Project (comprising Turkey, Yugoslavia, Greece, Italy, Spain and Portugal) and, without describing the specific planning techniques that will be utilized by each country, presents a systematic discussion of the various steps in educational planning. Ch. 2 covers manpower-forecasting; chs. 3 and 4 translate such forecasts into educational requirements; ch 5 takes up demand-planning in education; and ch. 6 touches on the question of costing. (M. Blaug)

E6300.0900 Svennilson, Ingvar, *et al. Targets for Education in Europe in 1970.* (Policy Conference on Economic Growth and Investment in Education,

Pt. 2.) Paris, Organization for Economic Cooperation and Development, 1962.

An exercise in overall educational forecasting applied to the future situation in Europe.

E6300.0940 Swift, F.H. *European Policies of Financing Educational Institutions. The Practices of France, Czechoslovakia, Austria, Germany, and England and Wales.* University of California Publications in Education, Vol. 8. Berkeley, Calif., University of California Press, 1933-1939.

An invaluable source of information about European educational finance in the inter-war period. (M. Blaug)

E6300.1200 Vaizey, J. and Debeauvais, M. "Economic Aspects of Educational Development," *Education, Economy and Society*, eds. A.H. Halsey, J. Floud, and C.A. Anderson, Glencoe, Ill., Free Press, 1961.

The consensus of opinion of the economists attending the seminar of the International Association of Universities in Italy, July 1960, about the contribution that Educational planning can make to economic growth. (M. Blaug)

E6300.1240 Van Waeyenberghe, M.R. *La Planification de l'Education dans ses Rapports avec la Planification de l'Economie.* Berlin, Deutsche stiftung fur Entwicklingslander, July 1963.

An educator's view of the task and process of educational planning, setting it in a context of national development.

Belgium

E6301.0200 D'Hoogh, C. *Problemes Economiques de l'Enseignement. Contribution a l'Etude de l'Investissement en Capital Humain.* Bruxelles, Publications de Centre des Problemes Sociaux et Professionels, 1963.

A review of the work of Edding, Schultz and Vaizey, and a study of the costs of education in Belgium 1907-1938, the demand and supply of teachers 1950-1960, and relevant current issues in Belgian educational planning. Includes a tri-lingual bibliography. (M. Blaug)

E6301.0700 Organization for Economic Cooperation and Development. Developpement des Ressources Humaines, Rapports de Boursiers. *Essai d'Analyse du Financement de l'Enseignement Universitaire in Belgique.* Paris, OECD, 1966.

A study in the finance of higher education in Belgium carried out in 1964. (M. Blaug)

E6301.0800 Renneboog, F. *Previsions des Populations Ecolaires.* Bruxelles, Centre d'Etude des Problemes Sociaux et Professionels de la Technique, 1962.

Discusses methodology of forecasting enrollments and output of the education system at all levels, and gives detailed results for Belgium obtained with the use of these methods.

Britain

E6302.0100 Annan, Noel, "Through the Looking Glass," *Publications of the Modern Language Association of America*, Volume 82, No. 3 (June 1967) 3-11.

Explores the effects of British and American educational philosophy on one another with special emphasis on the cost-benefit methods that the author advocates for the planning and financing of British universities.

E6302.0120 Arregger, C.E. (ed.). *Graduate Women at Work: A Study by a Working Party of the British Federation of University Women.* Newcastle-upon-Tyne, Oriel Press Ltd., 1967.

Presents information collected in a sample survey on the occupations and earnings of women graduates, proportions in full-time or part-time work, reasons for married women returning to work and opportunities for training of older women. (M. Blaug)

E6302.0140 Blaug, M. "The Rate of Return on Investment in Education in Great Britain," *Manchester School of Economic and Social Studies*, Vol. XXXIII, No. 3 (1965).

E6302.0160 Bowen, W.G. "Assessing the Economic Contribution to Education: An Appraisal of Alternative Approaches," Higher Education. *Report of the Committee under the Chairmanship of Lord Robbins 1961-1963*, London, Her Majesty's Stationery Office, 1963, App. 4, p. 73-96. Cmnd. 2154-IV. Reprinted in *Economic Aspects of Higher Education*, ed. S.E. Harris. Paris, Organization for Economic Cooperation and Development, 1964. p. 177-201.

A useful review of the literature divided into (a) the simple-correlation approach; (b) the residual approach; (c) the returns-to-education approach; and (d) the forecasting-manpower-needs approach. (M. Blaug)

E6302.0180 Bowen, W.G. "University Finance in Britain and the U.S.: Implications of Financing Arrangements for Educational Issues," *Public Finance*, XVIII, No. 1 (1963), 45-83.

A comparison of patterns of university finance in Britain and in the U.S.A. and an attempt to indicate the educational implications of different methods of finance. Argues the case for a rise in student fees in both countries. (M. Blaug)

E6302.0200 British Broadcasting Corporation. *Educational Television and Radio in Britain: Present Provision and Future Possibilities.* London, BBC, 1966.

A collection of papers on the future use of TV and radio in education. M. Peston argues in "Educational Needs of the Country: Manpower and Resources, 1966-1980" (pp. 9-19) that as education becomes increasingly expensive, it will be necessary to substitute capital for labor in teaching. Other authors discuss how television is already used in schools and predict future development. (M. Blaug)

E6302.0220 Burston, W.H. "The Incidence of Taxation and of State Provision for Education: United

Kingdom," *The Yearbook of Education, 1956,* London, Evans Brothers, 1956, p. 180-197.

A good description of methods of financing education in the United Kingdom. (M. Blaug)

E6302.0240 Carter, C.F. "Can We Get Higher Education Cheaper?" *Journal of the Manchester Statistical Society,* (December 1965), 1-14.

Attacks the article by Woodhall and Blaug and denies that there is any evidence of inefficiency in British universities. The paper closes with a proposal to give British universities power to borrow on capital account. (M. Blaug)

E6302.0260 Carter, C.F. and Williams, B.R. "Proposals for Reform in University Finance," *Manchester School,* (September 1963), 255-261.

The authors' recommendations to the Robbins Committee: a new system of teaching grants, research grants, and capital grants. (M. Blaug)

E6302.0280 Corlett, J. *A Survey of the Financial Aspects of Elementary Education.* London, P.S. King, 1929.

An early study of the finance of British primary education in the nineteenth and twentieth century. Various methods of financing education are discussed, including the 'payment by results' scheme of 1871, and block and percentage grants. The cuts in educational expenditures in the 1920's are examined in detail. (M. Blaug)

E6302.0300 Dodds, H.W., Hacker, L.M., and Rogers, L. *Government Assistance to Universities in Great Britain.* Memoranda submitted to the Commission on Financing Higher Education. New York, Columbia University Press, 1952.

Hacker describes the structure of British universities, Rogers explains the way the UGC works, and Dodds discusses the general issues in central government grants to British universities. A readable account for American readers. (M. Blaug)

E6302.0320 Glennerster, H. *The Graduate School: A Study of Graduate Work at the London School of Economics.* Edinburgh, Oliver and Boyd, 1966.

A study based on several surveys of the nature of post-graduate supervision at the L.S.E. Chaps. 10 and 11 are particularly recommended as models of university cost analysis by type of course. (M. Blaug)

E6302.0340 Great Britain. Committee on Higher Education. *Higher Education.* London, Her Majesty's Stationery Office, 1963. (Cmnd. 2154–'The Robbins Report').

The report surveys higher education in Britain and makes proposals for its future expansion, taking into consideration a wide range of factors. Hence the thinking exposed is of great interest for educational planners. The appendices contain more detailed treatment of many subjects covered in the report, and also a wealth of statistical information.

E6302.0360 Great Britain. Department of Education and Science, U.K. *Children and Their Primary Schools.* A Report of the Central Advisory Council for Education (England). London, Her Majesty's Stationery Office, 1967, Vol. I: *The Report,* Vol. II: *Research and Survey.*

Most of the Plowden Report is outside the purview of the economics of education. But see Vol. I, chapter 5, 'Educational Priority Areas', pp. 50-68, on the question of regional inequalities in educational opportunities, and chapter 31, pp. 431-452, on the costs and priorities of the main recommendation. See also the 'Note of Reservation on Parental Contribution to the Costs of Nursery Education', pp. 487-489; and 'A Suggestion on the Supply and Training of Teachers', pp. 493-495. Vol. II contains 14 special surveys and studies, that were carried out for the Plowden Committee, including a 1964 National Survey of Parental Attitudes, pp. 93-178, analyzed with the aid of multiple regression techniques by G.F. Peaker, pp. 179-221; a study of post-war trends in the standards of reading of eleven year olds by G.F. Peaker, pp. 260-289; a survey of Manchester schools by S. Wiseman, pp. 347-400; and an analysis of variations in local provision of social services by B.P. Davies, pp. 617-633. (M. Blaug)

E6302.0380 Great Britain. Ministry of Education. *15-18.* Vol.1, (Report), Vol. 2, (Surveys). London, Her Majesty's Stationery Office, 1959.

A report which is important for the emphasis it places on educational reform in the context of economic and social change.

E6302.0400 Great Britain. Ministry of Education. *Building Bulletin.* London, Her Majesty's Stationery Office, October 1949.

A periodical publication discussing school building projects and topics in Great Britain.

E6302.0420 Great Britain. Memorandum by the U.K. Delegation to the United Nations Economic, Scientific and Cultural Organization, Conference of African States on the Development of Education in Africa, Addis Ababa, May 1961. *Proposals for a School Construction Programme in Africa.* London, UNESCO, 2 May 1961.

Brief mention is made of U.K. post-war experience in school building, and this is followed by suggestions for its adaption for utilization in an African context, particularly for research in school building and the diffusion of its results.

E6302.0440 Great Britain. National Advisory Council on the Training and Supply of Teachers. *The Demand and Supply of Teachers 1960-80.* London, Her Majesty's Stationery Office, 1962.

A discussion applying to the British situation, of one of the principal constraints on educational expansion–the shortage of qualified teachers. The approach used is of interest to other countries.

E6302.0460 Hall, R.T. *The Industrial Training Act, 1964.* Human Resources Development, Fellows Reports. Paris, Organization for European Cooperation and Development, 1966.

A survey of occupational training and technical education in Great Britain carried out as part of the M.R.P. Argues that industrial training boards, similar to those set up by the 1964 Act in Britain could usefully be set up in the M.R.P. countries to coordinate training programmes. (M. Blaug)

E6302.0480 Hans, N. *Comparative Education. A Study of Educational Factors and Traditions.* London, Routledge & Kegan Paul, 2d. ed., 1950.

This classic textbook in comparative education devotes one chapter to 'geographic and economic factors' which takes up little else than the differences between countries in the share of educational expenditures in the national budget and the differences in educational facilities in different parts of the U.K. (M. Blaug)

E6302.0500 Harris, R. and Seldon, A. *Choice in Welfare 1965. Second Report on an Enquiry Conducted by Mass-Observation Into the Extent of Knowledge and Preference in State and Private Provision for Education, Health Services and Pension.* London, Institute of Economic Affairs, 1965.

An interesting second attempt to combine the techniques of market research and opinion polling to discover how well-informed a national sample of British married men were about the finance of the social services, and how far they might use private welfare services if their costs were other than they are The findings are full of surprises and certainly do not suggest a consensus in favor of extending state services in all directions. (M. Blaug)

E6302.0520 *Higher Education. Report of the Committee under the Chairmanship of Lord Robbins 1961-1963.* London, Her Majesty's Stationery Office, 1963.

The Committee advocated an increase of about 80% in the number of students in full-time higher education in Great Britain over the next ten years, justifying that expansion by a forecast of the demand for higher education. The report includes a historical survey of the growth of higher education in Great Britain, some striking international comparisons, and a wealth of data on the characteristics of the British student population, the internal structure of British institutions of higher education, and the finance and administration of Universities and Training Colleges. Three appendices of statistics were published with the report: App. 1, *The Demand for Places in Higher Education.* pp. 342; App. 3, *Teachers in Higher Education.* pp. 259; and App. 4, *Administrative, Financial, and Economic Aspects of Higher Education.* pp. 259. Two additional appendices will be published in due course: App. 2, *Students and Their Education* and App. 5, *Higher Education in Other Countries.* The report has received a great deal of comment but not as yet a full-scale critique. See, however, the symposia in *Universities Quarterly,* March 1964, and *Forum,* Summer, 1964, particularly the papers by M. Trow and J.F. Floud. (M. Blaug)

E6302.0540 Horobin, G.W. and Smyth, R.L. "The Economics of Education: A Comment," *Scottish Journal of Political Economy,* (February 1960), 69-74. Reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

A valuable reply to the arguments of Friedman and Wiseman in favor of private education. Develops the economic case for state education along existing lines. (M. Blaug)

E6302.05[illegible] Jones, R.V. *Taking the Strain of Robbins.* London, The Times, 11 November 1963.

Using the scarcity of physicists in Britain as an example, the author shows how efforts to expand the supply tend to reduce it in the short run, because of the need for more teachers, which raises difficult problems for the planner.

E6302.0560 Judges, A.V. "The Social Cost of an Educational Programme," *Looking Forward in Education,* ed. A.V. Judges. London, Faber & Faber, (1955), 13-38.

An early rough estimate of the costs of education in Great Britain in 1955. (M. Blaug)

E6302.0580 Lee, K.M. "The Statistics of Education," *Journal of the Royal Statistical Society,* (1954), reprinted in M.G. Kendall, ed., *The Source and Nature of the Statistics of the U.K.* London, Oliver & Boyd, 2d. ed., 1956, II, 145-157.

A useful review of available British educational statistics, particularly historical data. (M. Blaug)

E6302.0600 Lees, D.S. "Financing Higher Education in the U.S. and in Great Britain," *Economics of Higher Education,* ed. S.J. Mushkin, Washington, D.C., Government Printing Office, (1962), 328-345.

A useful contrast between the two countries with data for recent years. (M. Blaug)

E6302.0620 Lees, D.S., chairman of Study Group. *Local Expenditure and Exchequer Grants. A Research Study.* London, Institute of Municipal Treasurers and Accountants, (1956). 352. Excerpts reprinted in *Perspectives on the Economics of Education. Readings in School Finance and Management.* ed. C.S. Benson, Boston, Houghton Mifflin, 1963, 354-363.

This masterly appraisal of the system of central grants to local authorities in England and Wales defended 'specific or percentage grants' which have characterized the English grant system for over a century and criticised proposals to replace them by 'unit grants' or 'general grants'. The book is now somewhat dated owing to the introduction of general or 'block grants' in 1959. The conclusions of the study are conveniently summarized on pp. 281-287. Chs. 10-11, pp. 222-250 deal specifically with grants for education. (M. Blaug)

E6302.0640 Leybourne, G.G. and White, K. *Education and the Birth-Rate. A Social Dilemma.* London, Jonathan Cape, 1940.

An early attempt to estimate the total costs, including income foregone, of secondary and university education in Great Britain in the inter-war years. The authors conclude that the real cost of formal education has been an important influence in reducing the birth rate, and they defend free public education on these grounds. (M. Blaug)

E6302.0660 Moser, C.A. and Layard, P.R.G. "Planning the Scale of Higher Education In Britain: Some Statistical Problems," *Journal of the Royal Statistical Society,* (1964), 473-513.

E6302.0661 Moser, C.A. and Redfern, F. "A Computable Model of the Educational System in England and Wales," 35th Session of the International Statistical Institute, Belgrade, 1965, in *Proceedings of the International Statistical Institute.* Bi-Annual Conference, London, ISI. Forthcoming, 1966. p. 14.

E6302.0680 National Advisory Council on the Training and Supply of Teachers. *The Demand and Supply of Teachers 1960-1980.* London, Her Majesty's Stationery Office, 1962.

Analyzes the current and projected shortage of teachers in Great Britain and outlines various proposals that might remedy the situation. (M. Blaug)

E6302.0700 National Union of Teachers. *Investment for National Survival.* London, NUT, 1962.

A proposal by an independent committee on the expenditures needed for future educational development in the U.K. An appendix by J. Vaizey and S. Pratt presents the statistical basis for the 1980 projection. (M. Blaug)

E6302.0720 Peacock, A.T. and Wiseman, J. "The Finance of State Education in the U.K.," *The Yearbook of Education, 1956.* London, Evans Brothers, (1956), 305-321.

A pioneer effort to estimate the costs of education in 1954 and to allocate the burdens and benefits of education between central and local governments and between broad income classes. (M. Blaug)

E6302.0740 Prest, A.R. *Financing University Education.* London, Institute of Economic Affairs, 1966.

This reprints the evidence presented by the author to the Robbins Committee and adds a postcript which reviews events, academic discussions and public debate in Britain since 1962 on loan schemes to students in higher education. (M. Blaug)

E6302.0760 Robbins, Lord. *The University in the Modern World, and Other Papers on Higher Education.* London, Macmillan, 1966.

Eight papers on higher education in Great Britain, including two speeches to the House of Lords complaining of the government's failure to adopt some of the key recommendations of the Robbins Report, and a significant address delivered at Harvard University in 1964 elaborating on the arguments of the Report concerning long-term manpower forecasting and student loans. (M. Blaug)

E6302.0780 Sleeman, J. "Educational Costs and Local Government Structure in Scotland," *Scottish Journal of Political Economy,* (November 1965), 281-292.

An analysis of the structure of public education costs in Scotland, particularly as between different local educational authorities. (M. Blaug)

E6302.0800 Stephenson, R.M. "Stratification, Education, and Occupational Orientation: A Parallel Study and Review," *British Journal of Educational Studies,* March 1958, 42-53.

Compares the U.S. and the U.K. and finds little difference in patterns of educational choice upon graduation from secondary schools. (M. Blaug)

E6302.0820 Stone, Richard. "A Model of the Educational System," *Minerva,* Vol. 3 (Winter 1965), 172-186.

Outlines a model of the British educational system designed to work out the present implications of future levels of educational activity as determined by the evolution of the demand for places and the economic demand for the products of education.

E6302.0840 Szreter, R. "Economists and Education: A Review Article," *Educational Review,* (June 1966), 213-221.

A discussion from the viewpoint of recent developments in the economics of education in Great Britain, by way of a review of Bowen's *Economic Aspects of Education,* Weisbrod's *External Benefits of Public Education,* Harbison and Myers' *Education, Manpower, and Economic Growth,* and West's *Education and the State.* (M. Blaug)

E6302.0860 Vaizey, J. "Comparative Notes on Economic Growth and Social Change in Education," *Comparative Education Review,* (June 1961), 7-13; "Education as Investment in Comparative Perspective", *ibid.,* (October 1961), 97-105.

Eclectic comments on the contribution of education to economic growth. Includes an estimate of the opportunity costs of education in the U.K. in 1955. (M. Blaug)

E6302.0880 Vaizey, John. *The Control of Education.* London, Faber and Faber, 1963.

The essays in Part 11 deal with a wide range of educational topics, e.g. expenditure, government control, teachers' salaries and status, mainly with reference to the United Kingdom.

E6302.0900 Vaizey, J. *The Costs of Education.* London, Allen & Unwin, 1958.

A comprehensive analysis of direct private and public expenditures on formal education in the U.K. from 1920-1955 in both money and real terms, with separate estimates for England and Wales, Scotland, and Northern Ireland, attempting to explain both variations in the total figure and changes within the total, in the course of which the author deals expertly with various aspects of British education–see e.g., the section on 'The Economics of Private Education'–pp. 148-155. See also Vaizey's proposal to convert 'public schools' into 'sixth forms': 'The Public Schools', The Establishment, ed. H. Thomas. London: A. Blond, 1959, pp. 23-49, and a similar proposal by C.A.R. Crosland, *The Conservative Enemy. A Programme of Radical Reform for the 1960's.* London: Jonathan Cape, 1962 ch. 11, pp. 167-183. (M. Blaug)

E6302.0920 Vaizey, J. "Education, Training, and Growth," *Economic Growth in Britain.* ed. P.D. Henderson. London, Humanities Press, (1966), 237-261.

This article estimates the expected rise in the amount of education embodied in the British labor force by 1980 as a result of the recent expansion of higher education and discusses the implications of this rise for the future growth of the British economy. (M. Blaug)

E6302.0940 West Midland Group. *Local Government and Central Control.* London, Routledge & Kegan Paul, 1956.

A study of local government and the provision of social services in four English midland counties, including an analysis of local variations in educational expenditures in 1938 and 1951. An attempt is made to analyze the effectiveness of each social service, and various indicators of the quality of education in the region are examined:

pupil-teacher ratios, proportion of pupils over 15, proportion of school leavers with school certificates, etc., but there is no direct comparison of costs or of the quality of education provided. (M. Blaug)

E6302.0960 Wiles, P.J.D. "The Nation's Intellectual Investment," *Bulletin of the Oxford University Institute of Economics and Statistics,* (November 1956), 279-290.

A pioneering estimate of the annual gross expenditure on both formal and informal education in the U.K. in 1953, together with a tentative estimate of net current educational expenditures in that year. (M. Blaug)

E6302.0980 Wiseman, J. "The Economics of Education," *Scottish Journal of Political Economy,* (February 1959), 48-58.

Shows that the fact that education yields public as well as private benefits provides a case for state assistance to parents, not direct provision of education by the state. Sketches an educational system for Great Britain in the light of this conclusion. (M. Blaug)

Czechoslovakia

E6303.0800 Slouka, Tomas. *Planning of Staff in Elementary Nine-Grade Schools.* Planovani Ucitelskych sil ZDS, Published at Vyzkumny Ustav Pedagogicky v Prace, 1967.

E6303.0820 Slouka, Tomas. *Problems of the Rebuilding of Elementary Nine-Grade Schools in Czech Regions,* (Problematika Prestavby Site ZDS v Ceskych Krajich) Published at Vyzkumny Ustav Pedagogicky v Praze, 1967.

E6303.0840 Slouka, Tomas. *Some Remarks on the Economy of Education and the Differentiated Instruction,* (Nekolik Poznamek k Ekonomii Vzdelavani a Diferencovanemu Vyucovani) Published at Krajsky Pedagogicky Ustav v Praze, Praha 1965.

Eastern Europe

E6304.0400 International Labour Office. "Manpower Planning in Eastern Europe," *International Labour Review,* Geneva, Vol. LXXXVI, No. 2 (August 1962), 3-35.

The article describes techniques of manpower planning under the Communist system, running from the general plan back to plans for the training and use of specialists, which in turn lead into the planning of education.

E6304.0800 Richmond, W.K. *Educational Planning: Old and New Perspectives.* London, Michael Joseph, 1966.

The book is chiefly concerned with contrasting methods of educational planning in Hungary and Czechoslovakia with the absence of planning, or what the author describes as a 'Micawberish weakness for muddling through', in England. There is, however, a brief section on 'educational investment and consumption' and on measuring the economic returns to education, which gives a very unsatisfactory picture of the state of the subject. The author declares that 'to say that the precise nature of the relationship between expenditure and returns in education is as yet dimly understood is a prize understatement,' without, however, citing a single study of this relationship. (M. Blaug)

E6304.0900 Skorov, G. *Manpower Approach to Educational Planning: Methods Used in the Centrally Planned Economicies.* Paris, UNESCO, 1963. (To be included in the UNESCO manual on Economic and Social Aspects of Educational Planning.)

The title of this paper is self-explanatory. Several methods which have been used in the Soviet Union are described.

France

E6305.0300 Debeauvais, M. "La Traduction des Objectifs d'Emploi en Objectifs d'Education," *Tiers-Monde. Problemes des Pays Sous-Developpes.* (janvier-mars, 1964), 83-105.

An exposition of methods of translating employment objectives into educational objectives, illustrated by French data. (M. Blaug)

E6305.0400 Engert, M. *New Trends in Polytechnical Education with Special Reference to Planning of Manpower Demand in the Long Run (Experience from the German Democratic Republic).* Cairo, Institute of National Planning, 15 May 1963.

An explanation of the new emphasis on the vocational element in education, designed to lead school pupils into occupations relevant to national manpower requirements.

E6305.0420 France, Commissariat General du Plan d'Equipement et de la Productivite. *Rapport General de la Commission de l'Equipement Scolaire, Universitaire. et Sportif.* Paris, Imprimerie Nationale, 1961.

The Report is concerned with the plan period 1962-65, but it also deals with the period up to 1970. The principal divisions of concern are the physical and personnel requirements for carrying out the plan, and the technical and administrative measures for its execution.

E6305.0500 Halls, W.D. *Society, Schools and Progress in France.* London, Pergamon Press, 1965.

The fourth chapter in this book provides an easy introduction to post-war educational planning in France. (M. Blaug)

E6305.0600 Institut d'Etude de Developpment Economique et Social. *L'Education de la Population Francaise et Son Evolution de 1850-1980.* Paris, IEDES, 1963.

The study compares two methods of calculating the stock of education–by rates of enrollment, and by census data on educational attainments.

E6305.0700 Institut National de la Statistique et des Etudes Economique. *Cout et Developpment*

de l'Enseignement en France. Ministere des Affaires Economiques et Financieres, Institut National de la Statistique et des Etudes Economiques. Etudes Economiques, No. 3, Paris Presses Universitaires de France, 1958.

A semi-official study of the costs of education in France in 1955, as well as a forecast of French educational costs in 1966. Along the way, useful comparisons are made of enrollment ratios at all levels of education in various countries around the world: Germany, England, Canada, Spain, Japan, New Zealand, The Netherlands, and Sweden. (M. Blaug)

E6305.0900 Perroy, Henri. "Cout et Productivite de L'Enseignement," *L Revue de L'Action Populaire,* No. 166 (mars 1963), 315-30.

Begins with some calculations of the cost of education in France. Then discusses criteria of educational productivity and suggests their lack as a reason for the failure to establish clearly a relation between educational expenditure and production increases. With this qualification some international comparisons are made and the need for further efforts to establish educational productivity emphasized.

E6305.0940 Poignant, Raymond, "Establishing Educational Targets in France," *Planning Education for Economic and Social Development,* Paris, Organization for Economic Cooperation and Development, 1963, p. 205-22.

A description and evaluation of French educational planning methods.

E6305.0960 Poignant, Raymond. "La Planification de l'Expansion de l'Enseignement en France," *Tiers-Monde,* Paris, Tome I, Nos. 1-2 (janvier-juin 1960), 208-20.

An account of the planning devised to deal with the post-war expansion of education in France.

E6305.0980 Poignant, Raymond. "The Planning of Education in Relation to Economic Growth—France," *Policy Conference on Economic Growth and Investment in Education,* Pt. 4. Paris, Organization for Economic Cooperation and Development, 1962, p. 9-32.

The preparation and implementation of educational plans in France.

E6305.1200 Vermot-Gauchy, M. *L'Education Nationale dans la France de 1975.* Monaco, Futuribles, Editions du Rocher, 1965.

After a preliminary historical section on the growth of higher education in France, the book turns to detailed forecasts of the demand for highly qualified manpower over the next decade by means of estimates of sectoral labor-productivity coefficients. This section incorporates and develops materials previously published by the author. These forecasts of demand are then related to the likely supply of educated manpower up to 1975. (M. Blaug)

E6305.1220 Vermot-Gauchy, M. "Forecasting Needs for Engineers," *Forecasting Manpower Needs for the Age of Science,* Paris, Organization of European Economic Cooperation, 1960, 141 pp., pp. 59-76. Reprinted in *Readings on Education and Economic Development,* eds., M.J. Bowman, M.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

An excellent presentation of the technique employed in France to forecast the demand and supply of engineers. (M. Blaug)

E6305.1240 Vermot-Gauchy, M. "La Planification a Long Terme vers de Nouvelles Methodes d'Etude," Iere Partie; IIe Partie: "Expansion Economique et Besoins en Personnels Qualifies Perspectives 1959 a 1975," IIIe Partie: "L'Education et la Formation," *Bulletin SEDEIS. Futuribles.* Paris, Societe d' Etudes et de Documentation Economiques, Industrielles et Sociales, (1963), p. 44, 48, 54.

A detailed educational plan for France, with particular reference to highly qualified manpower. (M. Blaug)

E6305.1260 Vimont, C. "Methods of Forecasting Employment in France and Use of These Forecasts to Work Out Official Educational Programmes," *Economic Aspects of Higher Education,* ed. S.E. Harris. Paris, Organization for Economic Cooperation and Development, 1964, 223-246.

A review of French experience with employment forecasting and with translating these forecasts into educational requirements. (M. Blaug)

Germany (West)

E6307.0300 Edding, F. "The Planning of Higher Education in the Federal Republic of Germany," *Economic Aspects of Higher Education,* ed. S.E. Harris. Paris, Organization for Economic Cooperation and Development, 1964, 153-176.

A review of planning experience since the end of the war, a survey of current problems, and an enrollment projection for 1980. (M. Blaug)

E6307.0900 Widmaier, H.P. *Bildung in Neuer Sicht. Schriftenreihe des Kulturministeriums Baden-Wurttemberg zur Bildungsforschung Bildungsplanung Bildungspolitik.* Baden-Wurttemberg, Neckar-Verlag, 1966.

A forecast of the demand for highly qualified manpower by 1981 in one of the Lander of Western Germany, using the M.R.P. approach of OECD. By the use of a model of the entire educational system, this forecast becomes the basis of a projection for all levels of the educational system in Baden-Wurttemberg over the next fifteen years. (M. Blaug)

Greece

E6308.0300 Doussis, C. *Notes on Educational Planning in Greece.* Berlin, Deutsche Stiftung fur Entwicklingslander, 1963.

An account of educational planning experience in Greece, which has been in connection with the work of the OECD Mediterranean Regional Project.

E6308.0400 Fourre, Pierre. *Adult Education Techniques in Developing Countries–A Greek Case Study.* Paris, Organization for Economic Cooperation and Development, n.d.

This book is an account of adult educational methods used in Greece and experiences with them.

E6308.0440 France, Ministere de l'Education Nationale. *Les Contructions Scholaires.* Paris, Institut Pedagogique National, 1962.

This and similar earlier volumes detail the regulations relating to school building in France.

E6308.1200 Vassilion, L.G. *Esquisse d'un Plan d'Education Pour le Peloponese.* Human Resources Development, Fellows' Reports. Paris, Organization for Economic Cooperation and Development, 1966.

A study of Greek education in the light of manpower needs, carried out in 1964. (M. Blaug)

E6308.1300 Wald, S. *Individual Demand for Higher Education in Greece.* Human Resources Development, Fellow's Reports. Paris, Organization for Economic Cooperation and Development, 1966.

A study undertaken within the M.R.P. in 1964. (M. Blaug)

E6308.1340 Williams, Gareth. "Planning Models for the Calculation of Educational Requirements for Economic Development, Greece," *Econometric Models of Education,* Some Applications, Paris, Organization for Economic Cooperation and Development, 1965, Part IV, 77-93.

E6308.1400 Zolotas, X. *Economic Development and Technical Education.* Bank of Greece, Athens, 1960.

An opening section on the role of technical education in economic development leads up to a description of post-war shortages of skilled manpower in Greece, concluding with a series of recommendations for expanding technical, particularly agricultural and commercial education. A short appendix estimates the cost of the suggested reforms. (M. Blaug)

Holland

E6309.0500 Netherlands. Comissie voor Statistiek van het Interuniversitair Contactorgaan (Rapport). *De Ontwikkeling van het Aantal Academici tot 1980: Aanbod en Behoefte.* Zeist, W. de Haan, 1959.

A study of the future demand for and supply of higher education, and hence the anticipated number of university graduates, up to 1980, intended to provide data for use in establishing new universities.

E6309.0600 Netherlands, Ministerie van Onderwys, Kunsten, en Wetenschappen. *De Spreiding van het Moger Ondersijs tot 1970.* The Hague, Staatsdrukkerij, 1959.

A study of factors to be taken into account in deciding the location of new universities.

E6309.0800 Organization for Economic Cooperation and Development. *Educational Planning in the Netherlands. A Contribution from the Netherlands to the OECD Programme on Educational Investment and Planning.* EIP. Paris, OECD, 1966.

This document provides a description of educational planning in the Netherlands in the context of current flows of students through the various levels of the educational system. Ch. 7 (pp. 67-77) contains a succinct review of Dutch experience in forecasting the demand for doctors, engineers, and all university graduates. (M. Blaug)

E6309.0900 Passenier, J. "Verlaging der Leerlingenschall en de Behoefte aan Leraren Bij Het v.h.m.o.," *Economisch–Statistische Berichten,* (18 January 1961), 50-53.

The article discusses the demand for secondary-school teachers and pupil-teacher ratio.

E6309.1000 Ruiter, R. *The Past and Future Inflow of Students into the Upper Levels of Education in the Netherlands.* Paris, Organization for Economic Cooperation and Development, 4 November 1963.

An extensive resume of various methods used in the Netherlands to forecast grammer school and university enrollments.

Hungary

E6310.0400 Faluvegi, L. *The Planning of Budgetary Expenditure of Education on the Basis of a Mathematical Model. The Model Employed in Hungary.* Institut International de Finances Publique–Congres de Paris, 1965.

Italy

E6311.0100 Borghi, Lamberto and Scarangello, Anthony. "Italy's Ten-Year Education Plan," *Comparative Education,* New York, Vol. 4, No. 1 (June 1960), 26-30.

A critical commentary on the plan, which argues in favor of the coordination of the planning of education with that of other social services if educational planning is to give maximum assistance to development.

E6311.0200 Centro Studi Investimenti Sociali, "Costi e Ricavi dell'Instuizione," (Costs and Returns of Education) A Study for the Italian National Research Council, CENSIS Bulletin No. 21-22.

The research covers a long period of time, from the beginning of the century up to now. The purpose was: (a) To check over a sufficiently large period of time the long-term relations between income growth and educational expenditure; (b) to provide a wide reference basis for those who want to make forecasts for the future. The outline of the research, much simplified, was as follows: I. The increase of labor force and capital explains only a part of income increase. To what extent expenditure on education accounts for the total input productivity or

the 'residual factor' (As is called by economists the portion of income increase not explained by the increase of the two major production factors, i.e. labor and capital)? II. To answer this question, we had first of all to estimate the educational expenditure, broken down as follows: Government expenditure for State school; local administrations' expenditure for State school; expenditure of the private sector for private school; individual's expenses (taxes, books, etc.); foregone earnings of students, i.e. the earnings that they would have received if they worked instead of attending school (To estimate foregone earnings we had to calculate the average wages for workers in the school age groups). III. At the same time, it was necessary to estimate the part of the national income increase, from the beginning of the century up to the present time, which could not be explained with the increase of labor and capital. The residual factor–or the increase of total input productivity–was calculated with two different procedures: productivity indexes and aggregate production function (of the Cobb-Douglas type). These two methods, however, are closely linked since the function underlying the productivity index is a production function of the Cobb-Douglas type. IV. In the next phase we had to calculate the value of the stock of education accumulated in the Italian active population. The procedure was the following: (1) To estimate the educational level of the total population; (2) To estimate the educational level of the active population; (3) To estimate the stock of education accumulated by the population in standard school years; (4) To calculate (from the results achieved for educational costs and expenditure) the value of the stock of education. (5) Finally, on the basis of the conclusions offered by the above work, we estimated tentatively the contribution of education to Italy's economic growth, following three different methods: (1) Comparing the physical capital and the educational capital; (2) Estimating the contribution of the stock of education to the increase in earnings; (3) Weighing qualitatively–on the basis of the stock (total and per capita) of standard school years–the "Labor" factor in the production function and productivity indexes.

E6311.0300 Di Stampa, Bozze. *Progresso Economico e Strutture Formative Nell'Italia del 1975.* Roma, SVIMEZ, January 1963.

The book discusses the manpower requirements of projected Italian economic growth, and their educational implications, qualitative and quantitative, both within and outside the school system.

E6311.0400 Gozzer, Giovanni. *Sviluppo della Scuola e Piano Decennale.* Roma, UCIIM, 1959.

Part I discusses the development of the Italian education system in relation to the Ten-Year development plan (1959-1969) for the country's economy.

E6311.0500 Italy. Ministry of Public Instruction. *Commissione di Indagine Sullo Stato e Sullo Suiluppo Della Pubblica. Istruzione in Italia Modelli Mathematici Usatri Come Mezzi Ausiliare por la Valutazione del Fabbisogno Finanziario in Relazione al Prevedibile Sviluppo Scelastico nel Paese.* II Documenti Allegati alla Relazione, All 4 p. 41, July 1963.

E6311.0520 Italy, Ministry of Public Education, Centro Europeo dell'Educazione. *Aspetti Economici.* n.d.

E6311.0540 Italy, Ministry of Public Education, Centro Europeo dell'Educazione. *L'Educazione Tecnologica.* n.d.

E6311.0600 Centro Europea dell'Educazione. *La Pianificazione Scolastica.* Rome, Fratelli Palombi Editori, 1961. (Collana "Scuola Europea," No. 5)

Besides offering Italian translations of several other major sources, this book includes a large number of papers by Italian authors, dealing with socio-economic factors in the educational structure, and many aspects of educational planning.

E6311.0640 Italy, Ministry of Public Education. Centro Europeo dell'Educazione. *Primato Tecnico.* n.d.

E6311.0650 Italy, Ministry of Public Education, Centro Europeo dell'Educazione. *Instruzione e Svilluppo.* n.d.

E6311.0660 Italy, Ministry of Public Education, Centro Europeo dell'Educazione. *Progretto Regionale Mediterraneo,* n.d.

E6311.0680 Italy, Ministry of Public Education, Centro Europeo dell'Educazione. *Scuola e Programmazione Economica,* n.d.

E6311.0700 Italy, Ministry of Public Education, Centro Europeo dell'Educazione. *Le Strutture Formative al 1975.* n.d.

E6311.0900 Martinoli, G. *Tecnica Sviluppo Economico Scuola,* Milano, Edizioni di Comunita, 1962.

Discussion of the future development of the Italian economy up to 1975, translation of this into labour force terms, and discussion of consequent educational needs until 1975.

E6311.0920 Martinoli, G. *Trained Manpower Requirements for the Economic Development of Italy–Targets for 1975. The Role of Education in Italian Economic Development.* Rome, SVIMEZ (Associazione per lo Sviluppo dell'Industria nel Mezzogiorno), 1960.

A discussion of the implications of the 1975 targets for Italian education. (M. Blaug)

E6311.0940 Martinoli, Gino. *L'Universita dello Svilluppo Economico Italiano.* Roma, Giuffre Editore, 1962.

A study of the relation of the Italian university system to Italian economic development. Considers expansion achieved during decade 1951-1961 and makes projections of further expansion needed up to 1975, including students, teaching personnel, and costs per student.

E6311.1000 Svimez. *Trained Manpower Requirements for the Economic Development of Italy. Targets for 1975.* Rome, Giuffre Editore, 1961.

A pioneering study in the needs for educational expansion in relation to long-term needs for economic development (over a period of 15 years).

Ireland

E6312.0800 Ireland. Ministry of Education. *Investment in Education.* Dublin, Stationery Office, 1965.

An educational plan for Ireland for the next decade, based on the manpower forecasting approach, drawn up by a Survey Team appointed by the existing Irish educational system, and a forecast of probable future enrollments and teacher requirements. Pt. II considers the patterns of employment of educated people and the social determinants of staying on at school, projects the requirements for educated manpower by 1971, and calculates the likely manpower deficits by that date. Pt. III discusses the efficiency of the educational system at the primary and secondary level and examines the structure of educational finance in Ireland. Pt. IV examines the various ways of dealing with the forecasted manpower deficits, and contains, in addition, an interesting general discussion of the relationship of education to economic progress in the context of a market economy. Throughout the volume there are comparisons to other European countries, and particularly the United Kingdom. (M. Blaug)

Norway

E613.0400 Fidan, N. *Regional Aspects of Secondary Education in Norway.* Kirke og Undervismingsdepartementet, April, 1965.

E6313.0800 Pollen, P. and Eide, N. "Model for the Accounting of Current Expenses in Primary Schools," Ministry of Education, Norway, February, 1965.

Poland

E6314.0200 Charkiewicz, Michal. *Planning of the Qualitative Reproduction of Human Resources.* Paris, UNESCO, 18 June 1963.

Using examples of Polish experience, the paper describes a methodology for human resource planning which involves using the educational system as a means to produce manpower.

E6314.0500 Ozga, Wladyslaw. "Buts et Methodes de la Planification du Developpement de l'Education en Pologne," *Tiers-Monde,* Tome I, Nos. 1-2 (janvier-juin 1960), 95-117.

Accounts of educational planning in Poland, and its relation to economic development.

Soviet Union

E6315.0300 Dewitt, Nicholas. *Education and Professional Employment in the USSR.* Washington, D.C., National Science Foundation, 1961.

A study of the Soviet educational system is followed by an examination of the employment of Soviet manpower, thus providing material relevant to the study of Soviet educational planning, and its integration in the planning of the economy.

E6315.0400 Jamin, V.A. "The Economic Effects of Popular Education in the USSR," *International Economic Association Conference on the Economics of Education.* London, Macmillan, 1965, p. 324-334.

In this very enigmatic paper, Professor Jamin of the Association of Soviet Economic Scientific Institutions discusses methods currently in use in the USSR to measure the economic value of education. Unfortunately, the example given (pp. 328-331) seems to make no sense; either some passages have been left out or the translation has distorted the meaning of the original. (M. Blaug)

E6315.0460 Kahan, A. "Some Russian Economists on Returns to Schooling and Experience," *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

The first systematic critique of Russian work on the rate of return to investment in education. (M. Blaug)

E6315.0480 Kaser, M.C. "Economic Aspects of Education," Part IV of International Institute for Educational Planning, *Report on Educational Planning in the USSR,* Paris, IIEP, (Forthcoming)

The techniques used by the Ministries of Education and Finance and the State Planning Commission of the USSR in budgeting the cost of education are described in the first section, with particular reference to the crucial function of unit-costs, of central versus autonomous financing and the share of resources devoted to education. In the second section, Soviet research on the economic efficiency of education is reviewed with observations on the constraints to experiment in the USSR by the centralization of curricula and other 'methodological' controls: the main theme of research is shown to be on the relative efficiency of day and part-time study, but the pioneering work of Strumilin (1924) is receiving renewed attention, particularly by Zhamin and Associates (Institute of Economics of the Academy of Sciences and State Pedagogical Institute) and Maslov (Institute of Economics of the Siberian Branch of the Academy of Sciences) on educational efficiency as evidenced by skill or initiative in eventual occupation.

E6315.0500 Noah, H. J. *Financing Soviet Schools.* Studies of the Russian Institute, Columbia University. New York, Teachers College Press, 1966.

The first comprehensive study of Soviet educational finance, including estimates of total real expenditures on education in the USSR since 1940, showing that general education has been favored in recent years at the expense of specialist training. An important chapter on teachers' salaries demonstrates that Soviet teachers are not particularly well paid. (M. Blaug)

E6315.0520 Nozhko, K.G. *Methods of Estimating the Demand for Specialists and of Planning Specialized Training Within the USSR.* Statistical Reports and Studies. Paris, UNESCO, 1964.

After some historical remarks, the author explains in detail the two methods currently employed in the USSR to forecast the demand for high-quality manpower. A closing section discusses long-term educational planning in the USSR. The appendices contain relevant statistics and model forms for estimating the demand for teachers in 'general education schools'. A brief bibliography of Russian sources is included. (M. Blaug)

E6315.0700 Shapovalenko, S.G., ed. *Polytechnical Education in the USSR.* UNESCO Monographs on

Education–III. Paris, UNESCO, 1963.

This volume by a number of Soviet educationists reviews Marxist-Leninist ideas on polytechnical education, Soviet experience with technical and vocational education in the years 1917-1958, and then goes on to explain and defend the 1958 reform of technical education in the USSR, illustrating its implications for the teaching of a number of individual subjects. Includes the text of the 1958 Reform and a Russian bibliography. (M. Blaug)

E6315.0740 Strumilin, S.G. *The Economic Significance of National Education. Paper given at the International Economic Association Conference on the Economics of Education, Menthon St. Bernard,* 29 August -7 September 1963.

Though written in 1925, this article is of interest as showing some of the methodology used by early Soviet planners in trying to determine the economic significance of educational investment.

E6315.0760 Strumilin, S.G. "The Economic Significance of National Education," Planovoe Khoziaistvo, Nos. 9-10 (1924), reprinted in *Problemi Ekonomiki Truda.* Moscow, Gos. Izdatelsvo Pol. Literaturi, 1957, reprinted in English in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

A classic article based on a sample of Leningrad workers and the very first to attempt to measure the returns to education. (M. Blaug)

E6315.0780 Strumilin, S.G. "The Economics of Education in the USSR," *International Social Science Journal.* Vol. XIV, No. 4 (1962).

An explanation of Soviet methods of estimating the contribution of education, also available in a UNESCO *Handbook,* No. 401. (M. Blaug)

Spain

E6316.0100 Artigas, D. and Joaquin Tena, "Plan for School Construction in Spain," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963.

An example of educational planning concerned with a particular aspect of the educational system.

E6316.0200 Emmerij, L.J., "Planning Models for the Calculation of Educational Requirements for Economic Development, Spain," *Econometric Models of Education, Some Applications,* Paris, Organization for Economic Cooperation and Development, 1965. Part II, p. 33-53.

This paper presents a number of variations of the Model and their applications to the actual situation in Spain. Thus, the interrelationship between the Spanish educational system and the economic development this country wishes to achieve has been expressed and studied in a simple mathematical form. This model approach, among the many techniques for studying this question, has its own set of advantages and pitfalls. It will be demonstrated, however, that the model's simplicity in no way impedes its tremendous capacity to be adapted to different situations. The educational system in Spain is briefly described below. The section entitled 'The Model and its Application to Spain' deals successively with: the original model, the disaggregation of the economy by sector; the correction for drop-outs and effective length of study; changing coefficients; the introduction of more types of manpower and education, and finally, an attempt to shift the model to a marginal approach. The economic development of Spain is expected to make considerable progress in the coming years. The first economic plan will start in 1964 and will cover the period until 1967. A heavy strain will be put on the educational system of the country, and the needs that this creates are recognized by all those who are concerned with these questions in Spain. A considerable amount of detailed work has been done by the Spanish M.R.P. team to establish a long-term educational plan with relation to the economic development perspectives. It is hoped that this paper will be considered as an additional tool for their work. (Author)

E6316.0400 International Bank for Reconstruction and Development. *The Economic Development of Spain.* Report by the IBRD. Baltimore, The Johns Hopkins Press, 1963.

The first IBRD mission report on a European country. Reviews the measures for educational expansion proposed by the OECD Mediterranean Regional Project. (M. Blaug)

E6316.0500 Jallade, J-P. *Contribution a une Planification a Moyen Terme de l'Enseignement en Espagne,* Human Resources Development, Fellows' Reports. Paris, Organization for Economic Cooperation and Development, 1966.

A study of manpower needs in Spain up to 1971, carried out in 1964. (M. Blaug)

E6316.0800 Spain, Ministerio de Educacion Nacional. *La Escuela Unitaria Completa.* Madrid, Ministerio de Educacion Nacional, Julio 1961.

A brief description, amply illustrated, of the one-teacher schools which form an important part of the National Plan of School Construction, with parallel texts in Spanish, French and English.

E6316.0840 Spain, Ministry of Education. *Las Necesidades de Educacion y el Desarrollo Economico-Social de Espana.* Madrid, Ministerio de Educacion Nacional-OCDE, Diciembre 1963.

This is the Spanish 'Country Report' of the Mediterranean Regional Project. It describes the existing educational situation, the extent of educational needs to satisfy economic and professional requirements, and proposes educational policies to meet these needs, with details of costs.

Sweden

E6317.0400 Husen, Torsten. *The Role of Educational Research and Planning in Connection with the Swedish School Reform.* Berlin, Deutsche Stiftung fur Entwicklungslander, 1963.

The author describes the researches undertaken in connection with the planning of Swedish school reform, which is to provide comprehensive schooling for all up to the age of 16.

E6317.0500 Moberg, Sven, "The Planning of Education in Relation to Economic Growth–Sweden," *Policy Conference on Economic Growth and Investment in Education,* Pt. 4. Paris, Organization for Economic Cooperation and Development, 1962. p. 33-40.

Remarks on the system of educational planning used in Sweden.

E6317.1000 Wallberg, K. and Cassel, P.G. *Demand for Higher Secondary School (Gymnasium) Education in Sweden.* Paris, Organization for Economic Cooperation and Development, 22 November, 1963.

A study of the factors influencing the demand for gymnasium studies in Sweden and their relative strengths, as a basis for predicting the future needs for study facilities.

Yugoslavia

E6318.0300 Elazar, Moric, "The Planning of Education in Relation to Economic Growth–Yugoslavia," *Policy Conference on Economic Growth and Investment in Education,* Pt. 4. Paris, Organization for Economic Cooperation and Development, 1962. p. 41-52.

Remarks on the preparation and financing of educational plans in Yugoslavia.

E6318.0400 Haas, Herta, "Establishing Educational Targets in Yugoslavia," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, p. 195-204.

A description of the educational planning process as it operates in Yugoslavia.

LATIN AMERICA

E6400.0100 Babino, Ernesto F. *Estudio Comparado de la Educacion Tecnica en America Latina.* Washington, D.C., Union Panamericana, 1963.

This survey of Latin American technical education devotes particular attention to labour force structure and plans for technical education, and financial, personnel and physical resource problems.

E6400.0120 Bardeci, O.J. and Escondrillas, F. *Financiamiento de la Educacion en America Latina.* Washington, D.C., Union Panamericana, 1963.

Part I examines elements of the recent financial situation in Latin American education, while Part II discusses some of the financial aspects of education having most future significance.

E6400.0140 Beneveniste, G. *La Educacion de Adultos en America Latina.* Washington, D.C., Union Panamericana, Enero 1963.

A review of adult education in Latin America, dealing with both its nature and its scope, is followed by examples of initiatives in adult education in a number of countries outside the region.

E6400.0160 Carelli, Dino. *Cambios Estructurales en el Planeamiento de la Educacion.* Santigo, Chile, Instituto Latinamericano de Planificacion Economica y Social, n.d.

E6400.0180 Carelli, Dino. *Cuadros Comparativos para el Analisis de Cualidad Escolar.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.0200 Carelli, Dino. *Diagnostico del Rendimiento de un Sistema Escolar.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.0220 Comas, Juan. "La heterogeneidad cultural y el planeamiento integral de la educacion en America Latina." *La Educacion,* Ano. V, No. 17 (1960), 24-47.

The article is concerned with bringing to the notice of educational planners some relevant anthropological factors.

E6400.0240 Consejo Superior Universitario Centroamericano (CSUCA). *Algunos Aspectos Socioeconomicos de la Poblacion Estudiantil Universitaria Centroamericana del ano 1962.* San Jose, Costa Rica, CSUCA, Octobre, 1963.

Extensive statistics are provided of the demographic character, aspirations and background of the university student population in Central America.

E6400.0260 Correa, Hector. *El Coeficiente de Retencion y la Adaptacion Cuantitativa de la Educacion al Crecimiento Accelerado.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.0280 Correa, Hector. *La Inversion y la Adaptacion Cuantitativa de la Educacion al Crecimiento Accelerado.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.0300 Daniels, Marietta. *Bibliotecas Publicas y Escolares: Sus Necesidades y Plan de Accion Propuesto Dentro de la Alianza Para el Progreso.* Washington, D.C., Union Panamericana, 1963.

The need for extension of library services in Latin America is dealt with in this study, which examines the dimensions of the shortage and makes suggestions for action to overcome it.

E6400.0320 De Escondrillas, Fernando. *Algunos Aspectos del Financiamiento de la Educacion en America Latina.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.0340 De Escondrillas, Fernando. *Esquema para el Analisis y Diagnostica de un Servicio Educativo.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.0360 Del Rio, Fernando. *La Ensenanza Agropecuaria en America Latina.* Washington, D.C.,

Union Panamericana, 1963.

A brief survey of the current situation, its shortcomings, and the future needs of agricultural education in Latin America.

E6400.0380 Diez-Hochleitner, Ricard. "Administracion y Planeamiento de la Educacion," *La Educacion,* Ano V, No. 17, (eneromarzo 1960), 7-16.

The article discusses educational planning as an administrative process, both internally, and in the context of the wider process of government. It is derived from the course of the same name held during the 'Curso Interamericano sobre Planeamiento Integral de la Educacion' Bogota, 1959.

E6400.0400 Diez-Hochleitner, Ricard. *Educational Planning in Latin America: A Regional Approach.* Berlin, Deutsch Stiftung fur Entwiklungslander, 1963.

An evaluation of Latin American progress in educational planning, at the national and regional levels, and a description of the most difficult problems facing Latin American educational planners.

E6400.0420 Dutra da Fonseca, G. and Van Gelderen, A.M. *La Contribucion de la Iniciativa Privada a la Educacion en America Latina.* Washington, D.C., Union Panamericana, 1963.

A survey of the private sector of education in Latin America, including an examination of its failure to be included in exercises in educational planning, carried out by means of case studies of seven countries.

E6400.0440 U.N. Economic Commission for Latin America. "Conference on Education and Economic and Social Development in Latin America," *Economic Bulletin for Latin America,* Vol. VII, No. 2 (October 1962), 193-213.

This article briefly reviews the proceedings of the conference and sets out the conclusions and recommendations concerning integration of educational planning with economic and social planning, and international cooperation to assist this endeavor.

E6400.0460 U.N. Economic Commission for Latin America. "Economic Development and Education in Latin America," *Economic Bulletin for Latin America,* Vol. VII, No. 2 (October 1962), 215-40.

The article gives a rapid survey of the economy of Latin America, and obstacles to its development, and then considers the contribution that education can make in this situation.

E6400.0480 Enarson, Harold L. "University Education in Central America," *Journal of Higher Education,* Vol. XXXIV, No. 4 (April 1963), 196-204.

A description of the social, political and economic context in which the Central American universities have developed, and the effect of this on the higher education offered, is followed by a description of the new initiatives in inter-university cooperation being fostered by CSUCA, in particular in the field of general studies.

E6400.0500 Escondrillas, F. de. *Esquema de una Guia Para la Elaboracion de Presupuestos de Educacion.* Santiago, Instituto Latinoamericano de Planificacion Economica y Social, 1962.

A paper outlining, for training purposes, the steps in the process of educational budgeting.

E6400.0520 Escondrillas, F. de. *Esquema Para el Analisis y Diagnostico de un Servicio Educativo.* Santiago, Instituto Latinoamericano de Planificacion Economica y Social, Septembre 1963.

By showing the factors to be considered in evaluating an educational effort, in this case characterized by the Latin American concept of the 'servicio', the paper in effect indicates the types of statistical data required as a basis for educational planning.

E6400.0540 Escondrillas, F. de. *Esquema Para la Formulacion de un Programa de Educacion.* Santiago, Instituto Latinoamericano de Planificacion Economica y Social, Septembre 1963.

A brief paper setting out factors to be considered and procedures to be followed in formulating an educational programme.

E6400.0560 Fernandez, H. Rafael. *Planeamiento y Educacion.* Caracas, Fundacion Editorial Escolar, 1962.

An ideological justification of educational planning, followed by a review of planning activities in Latin America and elsewhere, and concluding with a few remarks on the place of educational planning in development.

E6400.0580 Fernandez, H. Rafael. *Situacion del Planeamiento Integral de la Educacion en America Latina.* Washington, D.C., Union Panamericana, 1963.

The study includes a history of Latin American educational planning efforts, with a country-by-country review of the existing situation, a consideration of the efficacy of planning as a mechanism for change, an evaluation of results, and recommendations for future action.

E6400.0600 Ferrer Martin, S. *Curso de Planeamiento de la Educacion 1963. Evaluacion.* Santiago, Instituto Latinoamericano de Planificacion Economica y Social, October 1963.

A detailed evaluation of the course, carried out with the help of responses to questionnaires given by the participants.

E6400.0620 Ferrer, Sebastian. *Metodos Estadisticos Aplicados al Planeamiento Educativo.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.0640 Institut d'Etude du Developpement Economique et Social. *Perspectivas de Desarrollo de la Educacion en 19 Paises Latinoamericanos (1960-1970) y Anexos.* Washington, D.C., Union Panamericana, 1963.

This study sets up a socio-economic typology of the Latin American countries, and examines educational output, its qualitative significance, educational costs and projected expenditures. The 'Anexos' include an examination of the manpower situation.

E6400.0660 The International Institute for Educational Planning. *Problems and Strategies of Educational Planning: Lessons from Latin America.* Paris, IIEP, n.d.

E6400.0680 International Institute of Educational Planning. *Problems and Strategies of Educational Planning in Latin America.* First Seminar of the IIEP, Paris, 1964. Paris, IIEP, 1964.

H. Correa, in a paper entitled 'Have Economic Plans Paid Enough Attention to Education in Latin America?', shows that educational bottlenecks in Colombia and Ecuador threaten the fulfillment of current economic targets. M.G. Louri writes on 'Structure and Problems of Educational Development in Latin America', and constructs a typological classification of Latin American educational systems. S.F. Martin replies in the negative to the question 'Has Educational Planning Paid Enough Attention to Economic Factors?'. M. Wolfe considers 'Financial Bottlenecks to Educational Development in Latin America'. L.M. Bravo discusses 'The Economic Development', with particular reference to Mexico. R.F. Lyons reviews the 'Policy Implications of the OECD Mediterranean Regional Project'. Practical suggestions for 'Planning Educational Innovation' are canvassed by G. Benveniste. T. Balogh complains of the failure to create the institutional conditions for effective agricultural education in a brief paper on 'Land-Tenure, Education and Development'. C.D. Ewers addresses himself to 'Project Analysis and Programming for International Financing'. And B. Benvenists follows this up in 'Current Problems and Issues in External Aid for Education'. 'Possible Criteria for External Aid to Education' are weighed by L. Cerych. J.R. Moreira provides a review of current efforts in 'Educational Planning in Latin America', based on a questionnaire distributed to the delegates at the UNESCO Santiago meeting of 1963. R. Gregoire deals with 'The Organizational Principles for Effective Educational Planning'. Lastly, G. Skorov and R. Poignant survey respectively 'Administrative Aspects of Educational Planning in the USSR' and 'Educational Planning Practice in France'. (M. Blaug)

E6400.0700 International Labour Office. *Quantitative and Qualitative Evaluation of Manpower in Relation to Educational and Vocational Training Requirements Arising Out of Economic Development.* U.N. Economic and Social Council, Santiago, Chile, 15 February 1962.

Description of working methods for evaluating manpower needs as a basis of educational requirements for development.

E6400.0720 Latin American Demographic Centre. A Demographic Analysis of the Educational Situation in Latin America. U.N. Economic and Social Council, Santiago, Chile, 2 January 1962.

Contains a wealth of demographic data essential to the formulation of educational plans in the Latin American countries, and discussions of factors influencing the size of schools' population.

E6400.0740 Lyons, R.F., ed. *Problems and Strategies of Educational Planning. Lessons from Latin America.* Paris, International Institute of Educational Planning, 1965.

This volume includes thirteen papers, including P.H. Coombs, 'Some Reflections on Educational Planning in Latin America', pp. 3-13; J.A. Mayobre, 'The Economic Background to Educational Planning in Latin America', pp. 13-19; M. Wolfe, 'Social and Political Problems of Educational Planning in Latin America', pp. 19-28; S. Lourne, 'Education for Today or Yesterday?', pp. 28-41; R. Diez-Hochleitner, 'A Regional Overview', pp. 45-50; M.H. Carrere, 'Some Aspects of Educational Planning in Latin America', pp. 53-57; R. Gregoire, 'Conditions for Effective Educational Planning', pp. 57-63; T. Balogh, 'Land Tenure, Education and Development in Latin America', pp. 67-73; M. Wolfe, 'Some Notes on Rural Educational Policies', pp. 73-76; A. Chaparro, 'Education and Training for Agricultural Development', pp. 76-82; C.T. Bernheim, 'Regional Cooperation at the University Level', pp. 82-88; R.F. Lyons, 'The Role of Cost Analysis in Educational Planning', pp. 88-91; and lastly, G. Benveniste, 'Highlights of the Seminar', pp. 95-111. (M. Blaug)

E6400.0760 Matinez Cabanas, Gustavo. *La Administracion de la Educacion en Algunos Paises de America Latina.* Washington, D.C., Union Panamericana, 1963.

This brief study, derived from experiences concerning Bolivia, Chile, Costa Rica and Mexico, examines the structures, methods and personnel of educational administration, and makes recommendations for their improvement.

E6400.0780 Moreira, J.R., "Education and Development in Latin America," *Social Aspects of Economic Development in Latin America,* eds., E. de Vries and J.M. Echavarria. Paris, UNESCO, 1963, I, p. 308-344.

This article concentrates on the differences in educational provision within Latin America and suggests some explanations. (M. Blaug)

E6400.0800 Organization of American States. *Development of Education in Latin America–Prospects for the Future.* Washington, D.C., OAS, 1963.

This important report recognizes an appropriate educational system as the basic condition for the development of Latin America which is the aim of the Alliance for Progress. Accordingly this review of the educational situation in Latin America specifies areas for priority action if the educational system is to make its proper contribution to Latin American development.

E6400.0820 Organization of American States. *Inter-American Economic and Social Council. Provisional Report of the Conference on Education and Economic and Social Development in Latin America.* Santiago, Chile, March, 1962. Washington, D.C., Economic Commission for Latin America, 1962.

Report of a conference jointly sponsored by UNESCO, ECLA and OAS, summarizing the discussions and reviewing the conclusions and recommendations formulated by the participants, pp. 1-105. Included are two valuable annexes prepared by UNESCO and ECLA on 'The Demographic, Economic, Social and Educational Situation in Latin America', pp. 155-238, and 'A Basis for an Estimate of Educational Targets for Latin America and Financial Resources Needed to Meet Them', pp. 259-285. (M. Blaug)

E6400.0940 Renault, Abgaro. "Financiamento do Ensino na America Latina," *Boletim do Centro Regional de Pesquisas Educacionais,* Vol. 2, No. 11-12, January-February, 1961.

E6400.0960 Roca, P. *et al.* "Costos de la Educacion," *La Educacion,* Ano VI, Nos. 21-22 (Enero-Junio 1961), 3-121.

A series of articles discussing the costs of education in various countries of North and South America.

E6400.0980 Rodriguez Bou, I. *La Educacion Superior en America Latina.* Washington, D.C., Union Panamericana, 1963.

The current situation of the universities is examined, both quantitatively and qualitatively, together with the scale of the need for future expansion.

E6400.1000 Romero Lozano, Simon. *Algunos Aspectos y Problemas del Diagnostico de la Situacion de la Educacion.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.1020 Romero Lozano, Simon. *Notas Sobre Caracteristicas y Elementos del Planeamiento de la Educacion.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.1040 Romero Lozano, Simon. *El Tratamiento de los Problemas de la Calidad de la Educacion en los Planes Educativos de America Latina.* Santiago, Chile, Instituto Latinoamericano de Planification Economica y Social, n.d.

E6400.1060 Romero Lozano, Simon y Cibotti, Ricardo. *Algunos Problemas de la Elaboracion del Plan de Desarrollo de la Educacion.* Santiago, Chile, Instituto Latinoamericano de Planification Economica y Social, n.d.

E6400.1080 Romero, Simon; Carelli, Dino; De Escondrillas, Fernando y Ferrer, Sebastian. *El Planeamiento de la Educacion: Aspectos Conceptuales y Metodologicos.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.1100 Silvert, K.H., and Bonilla, F. *Education and the Social Meaning of Development: A Preliminary Statement.* New York, American Universities Field Staff, Inc., 1961.

Using data from Argentina, Brazil, Chile and Mexico, the authors examine social stresses which hinder development, and the role of education as a means of obviating such stresses.

E6400.1120 Sunkel, Osvaldo. *Universidad, Desarrollo Economico y Planificacion.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

E6400.1500 United Nations Educational, Scientific and Cultural Organization. *A Basis for an Estimate of Educational Targets for Latin America and Financial Resources Needed to Meet Them: A Statistical Paper.* U.N. Economic and Social Council, Santiago, Chile, 19 March 1962.

Endeavours to estimate the scale of expansion needed to achieve universal primary education in Latin America by 1970, and the average unit costs of the operation.

E6400.1520 United Nations Educational, Scientific and Cultural Organization, *et al. The Demographic, Economic, Social and Educational Situation in Latin America.* U.N. Economic and Social Council, Santiago, Chile, 19 February 1962.

A survey of the demographic, economic and social situations in Latin America and their influence on educational needs. Hence an integrated approach to the planning of education and of development.

E6400.1540 United Nations Educational, Scientific and Cultural Organization. *La Educacion Primaria en America Latina.* Washington, D.C., Union Panamericana, 1963.

The aspects of primary education in Latin America which are considered in this survey include its obligatoriness, teachers, curricula, administration and financing.

E6400.1560 United Nations Educational, Scientific and Cultural Organization. *Final Report on the Inter-American Seminar on Overall Planning for Education.* Paris, UNESCO, 5 May 1961.

The report reviews the programme of the seminar, which took the form of a course on educational planning, including a summary of the subject matter of the various lectures and discussions.

E6400.1580 United Nations Educational, Scientific and Cultural Organization. *Overall Planning of Education.* U.N. Economic and Social Council, Santiago, Chile, 23 February 1962.

The methodology of education planning and the fruition of its endeavours.

E6400.1600 United Nations Educational, Scientific and Cultural Organization. *Philosophy and Scope of Overall Planning for Education.* Paris, UNESCO, 30 June 1961.

This document, the conclusions and recommendations of the first inter-American seminar on overall planning of education, makes proposals for the setting-up and operation of educational planning in the countries of Latin America, and also for the reform of their educational systems.

E6400.1620 Organization of American States. La Educacion en America Latina (Presentacion Estadistica). Washington, D.C., Union Panamericana, 1963.

The subjects discussed and extensively illustrated with statistics include: the framework of population growth and urbanization surrounding educational development, the development of education, enrollment ratios, educational output, the resources used by education, and case studies of the countries of Latin America.

E6400.1640 Organization of American States. *Repertorio de la Asistencia Tecnica y Financiera Para la Educacion en America Latina.* OEA, Washington, D.C., n.d.

In the words of its sub-title this directory is concerned to state who is offering, what is offered, and how it is offered.

E6400.1660 UNESCO, Organization of American States. *Seminario Interamericano Sobre Planeamiento Integral de la Educacion, Administracion*

y Financiamiento de la Educacion. Documentos de Trabajo, Tomo III, Washington, D.C., Union Panamericana, 1959.

Papers on the administrative and financial aspects of education, in relation to planning.

E6400.1680 UNESCO, Organization of American States. *Seminario Interamericano sobre Planeamiento Integral de la Educacion. Organizacion. Methodos y Tecnicas del Planeamiento.* Documentos de Trabajo, Tomo II. Washington D.C., Union Panamericana, 1959.

A series of articles on the various stages of the educational planning process, the administration of educational planning, and the place of public opinion, relevant to successful implementation of a plan.

E6400.1700 UNESCO, Organization of American States. *Seminario Interamericano sobre Planeamiento Integral de la Educacion. Planeamiento Cualitativo de la Educacion.* Documentos de Trabajo, Tomo IV, Washington, D.C., Union Panamericana, 1959.

Articles on planning particular levels or branches of education. However, the planning involved is that of the character of education offered rather than its scale. Hence the qualitative element in education's influence on development is here emphasized.

E6400.1720 UNESCO, Organization of American States. *Seminario Interamericano sobre Planeamiento Integral de la Educacion. Significado y Alcance del Planeamiento.* Documentos de Trabajo, Tomo I, Washington, D.C., Union Panamericana, 1959.

Papers justifying planning of education in a democratic community, and suggesting its nature, scope, extent, content, etc.

E6400.1740 Union Panamericana. *La Educacion 25-26 enero-junio 1962.* Washington, Union Panamericana, 1962.

This issue of the journal is mainly devoted to reproduction of some of the more important papers of the Conference on Education and Economic and Social Development in Latin America, held in Santiago de Chile in 1962.

E6400.1760 Union Panamericana. "Seminario sobre Planeamiento Integral de la Educacion," *La Educacion.* No. 11, (julio-septiembre 1958), 4-101.

Review of the conclusions and recommendations of the inter-American seminar on educational planning, 1958.

E6400.1780 Vera, O. "The Educational Situation and Requirements in Latin America," *Social Aspects of Economic Development in Latin America,* eds. E. de Vries and J.M. Echavarria, Paris, UNESCO, 1963, I, p.279-307.

An able summary of the educational situation and the outstanding educational problems of Latin America with illustrative data. (M. Blaug)

E6400.1800 Wolfe, Marshall. *Planning of Education in Relation to Socio-Economic Development,* U.N. Economic and Social Council, Santiago, Chile, 6 December 1961.

Introductory remarks on the relevance of planning of the different levels of education in relation to development, and factors to be considered.

Argentina

E6401.1000 Merrett, S. "Earnings, Work, Study and the Gestation Period of the Argentine Engineering Student," *Bulletin of the Oxford University Institute of Economics and Statistics,* Vol. 28, No. 2 (1966), 117-131.

A multiple regression analysis of the effects of student's age, social class, employment, and net earnings on academic performance in the Faculty of Engineering of the University of Buenos Aires in 1964. Students in this study are pictured as time-adjusters, adjusting their hours of work to their demand for earnings and trading-off hours of study, and leisure against working hours. (M. Blaug)

Bolivia

E6402.2000 United Nations Educational, Scientific and Cultural Organization. *Analisis de la Situacion Educacional de Bolivia.* La Paz/Paris, UNESCO, October 1962.

Discussion of the Bolivian educational system against the background of the Ten-Year Plan of Economic and Social Development, 1962-1971, paying particular attention to rural and agricultural education. Reference is also made to a five-year educational development plan. The mission emphasizes the need to set up formal educational planning machinery.

Brazil

E6403.0020 Abreu, Jaime. "Economia e Educacao," *Revista Brasileira de Estudos Pedagogicos,* Vol. 45, No. 101 (January/March 1966), 38-44.

E6403.0100 Sugestoes Sobre o Planejamento da Educacao no Brasil. *Boletim Informativo do Centro Brasileiro de Pesquisas Educacionais,* Vol. 110 (September 1966) 3-5.

E6403.0160 Brazil, Ministerio da Educacao e Cultura. *Plano Trienal de Educacao 1963-1965.* Brasilia, Departamento de Imprensa Nacional, 1963.

A brief review of the educational situation is followed by a listing of the targets to be achieved by the plan, and the consequent financial requirements.

E6403.0200 Cunha, Nadia Franco e Abreu, Jaime. "Alguns Aspectos do Ensino Medio no Brasil. Da Formacao do Seu Corpo Docente e dos Gastos Federais com a Educacao," *Boletim Informativo do Centro Brasilero de Pesquisas Educacionais,* Vol. 101 (September 1966), 22-33.

E6403.0220 Cunha, Nadia, e Abreu, Jaime. "Gastos Publicos Orcados para a Educacao no Brasil em

1965. Uma Approximacao Preliminar," *Boletim Informativo do Centro Brasileiro de Pesquisas Educacionais,* Vol. 102 (January 1966), 21-26.

E6403.0400 Havighurst, R.J. "Secondary Schooling and Socio-Economic Structure in Brazil," *Social and Economic Studies,* (March 1965), 106-118.

Reports on a number of surveys designed to reveal the economic and social impact of secondary education in Brazil. (M. Blaug)

E6403.0440 Havighurst, R.J. and Moreira, J.R. *Society and Education in Brazil.* Pittsburgh, University of Pittsburgh Press, 1965.

This is a study of the past and present role of education in Brazilian society with some attention to the economic value of education in the sense both of expected earnings from additional education and in future requirements of qualified manpower. (M. Blaug)

E6403.0500 Instituto Nacional de Estudos Pedagogicos, Centro Regional de Pesquisas Educacionais. *A Educacao em Minas Gerais em Seus Aspectos Socioeconomicos.* Belo, Horizonte, 1964.

E6403.0600 International Bank for Reconstruction and Development. *The Economic Development of Venezuela.* Report by the IBRD. Baltimore, The Johns Hopkins Press, 1961.

A description of the Venezuelan educational system and a list of policy recommendations. (M. Blaug)

E6403.0800 Maciel, Carlos Frederico. "Subsidios para um Plano de Educacao Plurienal e Integral para Pernambuco," *Cadernos Regiac Educacao,* Vol. 6, No. 11 (June 1966), 19-101; Vol. 6, No. 12 (December 1966), 19-57.

E6403.0820 Maciel, Carlos Frederico. *Sugestoes de Economia Educacional.* Recife, Centro Regional de Pasquisas Educacionais do Recife. Divisao de Estudos e Pasquisas Educacionais, 1965.

E6403.0840 Marins, Luciano. "Universidade em 3 Tempos: Conservacao, Reforma e Revolucao," *Educacao em Ciencias Sociais,* Ano. 6, Vol. 2, No. 18 (September-December 1961), 119-125.

Focaliza o problema da rentabiblidade dos recursos investidos no setor educacional, enquanto se procura conservar, reformar e revo lucionar a estrutura universitaria brasileira.

E6403.0860 Mascaro, Carlos Correa. "Custeio da Educacao e as Reformas Programadas," *Revista Brasileira de Estudos Pedagogicos,* Vol. 34, No. 80 (October-December 1960), 60-77.

E6403.0880 Moreira, J. Roberto. "Alguns Aspectos do Planejamento da Educacao no Brasil," *Revista Brasileira de Estudos Pedagogicos,* Vol. 43, No. 98 (June 1964), 175-188.

E6403.1000 Oliveira, Americo Barbosa de, "O Ensino, o Trabalho, a Populacao e a Renda," *Revista Brasileira de Estudos Pedagogicos,* Vol. 21, No. 53 (January-March 1954), 70-136.

E6403.1100 Pasquale, Carlos. *Densenvolvimento do Ensino Primario e o Plano Nacional de Educacao.* Documento apresentado a IIa Conferencia Nacional de Educacao. Porto Alegre, abr. 1966. Rio de Janeiro, Centro Brasileiro de Pesquisas Educacionais, 1966.

E6403.1120 Pasquale, Carlos. "Pela Racionalizacao dos Recursos Destinados ao Ensino," *Revista Brasileira de Estudos Pedagogicos,* Vol. 42, No. 96 (October-December, 1964), 223-239.

E6403.1140 Pasquale, Carlos. *Salario Educacao.* Belo Horizonte. Centro Regional de Pesquisas Educacionais de Minas Gerais, 1965.

E6403.1500 Teixeira, Anisio S. "Bases para una Programacao da Educacao Primaria no Brasil," *Revista Brasileira de Estudos Pedagogicos,* Vol. 27, No. 65 (January-March 1957), 28-46.

E6403.1520 Teixeira, Anisio S. "A Municipalizacao do Ensino Primario," *Revista Brasileira de Estudos Pedagogicos,* Vol. 27, No. 66 (June 1957), 22-43.

E6403.1540 Teixeira, Anisio S. *Ostensible and Real Values in Educational Policy.* Santiago, United Nations, 1961.

The paper shows how the concept of education prevalent in Brazil, and hence the structure of the school system, is out of step with the educational needs of national development.

E6403.1560 Teixeira, Anisio S. "Plano e Financas da Educacao," *Revista Brasileira de Estudos Pedagogicos,* Vol. 41, No. 97 (January-March, 1964), 6-16.

E6403.1580 Teixeira, Anisio S. "Sobre o Problema de Como Financiar a Educacao do Provo Brasileiro," *Revista Brasileira de Estudos Pedagogicos,* Vol. 20, No. 52 (October-December 1953), 27-42.

E6403.1601 United Nations Educational, Scientific and Cultural Organization. *Educacion y Economia en Venezuela.* Paris, UNESCO, March 1963.

Reviews the economic, demographic, social and educational situation, and then gives details of the plans for expansion of several sectors of education. Mission proposes an overall educational plan, but only in the form of a list of recommendations to act as guide-lines in its formulation.

E6403.1800 Vasconcellos, Myriam Brindeiro de Morais. "Levantamento dos Recursos Finan ceiros para a Educacao em Pernambuco," *Cadernos Regiao e Educacao,* Vol. 5, No. 10 (December 1965), 40-55.

E6403.2000 Venezuela, Oficina de Planeamiento Integral de la Educacion. *Anteproyecto de Esquemas Basicos Para el Planeamiento de la Educacion*

en Venezuela. Caracas, 1961.

Detailed review of the contents of educational programmes in Venezuela: (1) 12-year Plan 1962-1973. (2) Programme for 1962. (3) Execution of first year of 4-year Plan 1962-1965. (4) 4-year Plan 1962-1965. (5) Study of the existing educational system. (6) Concentration of technical services for educational planning.

British Guiana

E6404.0400 Germanacos, C.L., *et al. Report of the UNESCO Educational Survey Mission to British Guiana.* Paris, UNESCO, June 1963.

In the absence of any economic plan the Report attempts to survey and make proposals for the improvement of the educational system in close relation with potential economic development, and suggests the need for reformulation of Government proposals in relation to the resources available for their fulfillment. Hence the Report is designed to act as a basis on which an educational plan closely related to development needs can be formulated. Appendix L gives detailed proposals for an educational planning unit, and other planning activities.

Chile

E6405.0100 Blitz, Rudolph C. *Some Observations on the Chilean Education System, and its Relation to Economic Growth.* Chicago, Committee on Economic Growth, Social Science Research Council, 1963

The main part of this paper describes the Chilean educational pyramid, and offers reasons for the high rate of wastage illustrated.

E6405.0200 Chile. Ministro de Educacion Publica. *Bases Generales Para el Planeamiento de la Educacion Chilena.* No publisher, 1961.

A generalized treatment. States a desirable development of the Chilean educational system, and then shows the extent to which this is fulfilled, demonstrating both the quantitative and the qualitative shortcomings of the existing situation, and making proposals to overcome them. Final section outlines structure of proposed planning agency.

E6405.0400 International Labour Office. "The Use of Social Promoters at the Puno Base of the Andean Indian Programme," *International Labour Review,* Vol. LXXXVI, No. 3 (September 1962), 247-259.

The article describes a programme designed to gain the participation of the rural population in work for development. The training involved might conceivably come within the scope of educational planning.

Colombia

E6406.0200 Colombia. *Decreto No. 1637 of 1960.* Government of Colombia, 12 July 1960.

The text of the decree relating to the reorganization of the Colombian Ministry of Education, including in Section 18 details of the function of the Planning Office, and setting it in the context of the administrative structure of the Ministry.

E6406.0240 Colombia, Ministerio de Educacion Nacional. *Aspecto Economico de la Educacion el 'Banco Educativo Colombiano'.* Bogota, Ministerio de Educacion Nacional, n.d.

A brief description of the activities of the Colombian Educational Bank, an interesting initiative in the task of financing educational expansion.

E6406.0260 Colombia, Ministerio de Educacion Nacional. *Informe del Proyecto Para el Primero Plan Quinquenal.* Bogota, Ministerio de Educacion Nacional, Junio 1957.

Volume I is introductory and theoretical. Volume II concerns primary and teacher education. Volume III deals with general secondary education, and technical and commercial education. Volume IV is concerned with rural education. Volume V discusses the financing and administration of the plan.

E6406.0300 Diez-Hochleitner, Ricard. "La Planification Integrale de l'Educacion Depius 1956. Une Experience Pionniere en Colombie," *Developpement et Civilisations,* No. 5 (janvier-mars 1961), 67-75.

A brief description of the process of establishing educational planning in Colombia, a pioneer in this activity, followed by a brief review of the first plan.

E6406.0800 Labret, Joseph Louis. "Hacia una Educacion Integral Del Mundo Rural," *Revista Colombiana de Educacion* (Bogota). Vol. II, No. 6 (julio-septiembre 1960), 19-40.

The article proposes a scheme of rural education designed to foster the modernization of rural society and the countryside required in the process of development.

E6406.1000 United Nations Educational, Scientific and Cultural Organization, AID, IBRD. *Recommendations for Educational Planning.* (A Report to the Minister of Education, Republic of Colombia). UNESCO, 8 February 1963.

Discusses the functioning of the educational planning office in Colombia, and reviews the shortcomings of existing educational provisions. Makes proposals for reorganizing the Planning Office and about subjects for its study.

Ecuador

E6407.0200 Correa, H. *El Sistema Educacional y el Desarrollo Economico (El caso del Ecuador).* Santiago, Instituto Latinoamericano de Planificacion Economica y Social, Deciembre 1963.

An example of the use of mathematical methods to estimate the demand for qualified manpower for national development.

E6407.0400 Ecuador. *Decreto No. 632, 1960.* Quito, Government of Ecuador, 1960.

Text of the decree replacing the 'Oficina de Planificacion Educacional del Ministerio de Educacion' by the 'Departamento de Planeamiento Integral de la Educacion', and describing the position, functions, organization and financial basis of the latter.

E6407.0460 Ecuador, Departamento de Planeamiento Integral de la Educacion. *Cursos Regionales sobre Planeamiento Integral de la Educacion.* Quito, Ministerio de Educacion, 1961.

Description of the courses for educational planners established in Ecuador.

E6407.0500 Ecuador, Ministerio de Educacion Publica. *El Planeamiento Integral de la Educacion en el Ecuador.* Quito, Ministerio de Educacion Publica, 1961.

Detailed study of the 'Departmento de Planeamiento Integral de la Educacion', with respect to its structure, its work, and its place in the Ministry of Education and relations with other government organizations. Also contains the text of the Decree setting up the Department.

E6407.1500 United Nations Educational, Scientific and Cultural Organization. *Educacion y Economia en Ecuador.* Paris, UNESCO, July 1962.

Reviews the economic and educational situation, and a number of projects of educational development currently being undertaken, and makes recommendations for further activities of this nature, including overall educational planning.

Jamaica

E6408.1000 Smith, M.G. "Education and Occupational Choice in Rural Jamaica," *Social and Economic Studies.* (Jamaica). Vol. 9, No. 3 (September 1960), 332-54.

The study shows how experience of an unsuitable education system leads to occupational aspirations which cannot be satisfied in the rural environment, or perhaps elsewhere, leading to frustration and unemployment of the educated.

Mexico

E6409.0300 Carnoy, M. *The Cost and Return to Schooling in Mexico: A Case Study.* Ann Arbor, Michigan, A Ph.D. Dissertation submitted to the University of Chicago, University Microfilms, 1964.

A multiple linear regression analysis of the earnings of male urban and rural workers in Mexico in 1963, calculating the rate of return to various levels of primary, secondary, and tertiary schooling, after adjustments for various income-determining factors other than native ability. The study contains a great deal of useful information on Mexican education other than the estimates of the costs and expected earnings from education. The data were derived from several non-random sample questionnaires collected in only a few months by the author, and Appendix VI describing his survey technique may be useful to others contemplating similar studies in under-developed countries. (M. Blaug)

E6409.0320 Correa, H., "Ha Prestano la Planification Economica Atencion Suficiente a la Educacion?" *El Trimestre Economico.* Mexico D.F., October-December 1964.

E6409.0700 Khater, Roushdi. "Programas de Alfabetizacion de Adultos," *Boletin Trimestral,* Vol. XIV, No. 1 (Invierno 1961-1962), 5-12.

A brief account of the organization involved and stages of work in a literacy campaign for adults, which however lacks any breakdown of the costs involved.

E6409.0900 Mathur, J.C. "El Empleo de Los Medios Audiovisuales Para la Educacion de Adultos in un Mundo en Evolucion," *Boletin Trimestral,* Vol. XIII, No. 1 and 2 (Invierno 1960-61 - Primavera 1961), 14-35.

The article discusses the use of audiovisual educational techniques, in adult education, particularly as a means of inducing greater 'development-mindedness' among the adult population.

E6409.0920 Myers, C.N. *Education and National Development in Mexico.* Industrial Relations Sections, Department of Economics, Princeton University. Princeton, New Jersey, Princeton University, 1965.

This important contribution presents a regional analysis of the relationship between education and economic growth in Mexico since 1920. Among the author's more striking conclusions is that education appears to have increased rather than narrowed the regional disparities in Mexican economic growth. See also pp. 110-134 that traces some of the adaptive practices that have evolved, without benefit of planning or central direction to bridge the most important manpower gaps in the Mexican economy. (M. Blaug)

Paraguay

E6410.0100 Bakamis, William A. *Industrial Education and Paraguay's Future.* Asuncion, Servicio Cooperativo Interamericano de Educacion, n.d.

An examination of Paraguay's industrial labour requirements, and an educational plan to provide for their training.

Puerto Rico

E6411.0500 Hayward, B. *The Future of Education in Puerto Rico–Its Planning.* Puerto Rico, Departamento de Instruction Publica, 6 October 1961.

A statement of the tasks to be undertaken by educational planning in Puerto Rico, and the resources available for the purpose.

E6411.1000 Rodriguez-Pacheco, Osvaldo. *Some Aspects of Educational Planning in Puerto Rico.* Commonwealth of Puerto Rico, Department of Education, June 1963.

Reviews the educational situation in Puerto Rico, suggests the need for educational planning in the context of economic and social planning, and make proposals for studies preparatory to the establishment of an educational planning body in Puerto Rico.

Surinam

E6412.1000 Netherlands Delegation. *Report from Surinam. Referring to the Items on the Agenda on the Conference on Education and Economic and Social Development in Latin America.* Santiago, Chile, 5-19 March 1962.

Though written in rather individual English, this is an interesting study of the methods used in planning educational expansion in Surinam.

Venezuela

E6413.0500 Fernandez, H. Rafael. "Algunos Factores Humanos en el Planeamiento Integral de la Educacion," *Educacion.* Nos. 96-97, (enero-abril 1962), 23-40.

The article discusses the use of foreign and local experts, the planning team, and its conditions of work. It is concerned with the efficiency of work in planning rather than training for it.

E6413.0900 Shoup, C.S. *et al. The Fiscal System of Venezuela. A Report.* Baltimore, Md., The Johns Hopkins Press, 1959.

Makes a rough estimate of the rate of return on investment in education in levels I-III, and calculates the cost of achieving universal primary education in five years. (M. Blaug)

MIDDLE EAST

Afghanistan

E6501.0900 Sleight, G.F., *et al. A Survey of Education Within the Framework of Social and Economic Development in Afghanistan.* Kabul, UNESCO, n.d.

The report considers the provisions for education in the Second Five Year Plan 1962-1963 - 1966-1967, for economic development in relation to manpower requirements and the ability to pay for the resulting educational expenditure. This is followed by detailed consideration of the educational proposals, and recommendations for their modification, particularly with regard to agricultural education and the education of women. The report does not discuss educational planning beyond recommending the establishment of a Planning Unit in the Ministry of Education.

Algeria

E6502.0700 Hammiche, B. *Educational Planning.* Paris, UNESCO, 7 October 1963.

A brief description of the machinery set up, and the initial steps taken, for educational planning in the Algerian Democratic Republic.

Arab States

E6503.0300 El-Koussy, A. *Some Problems of Planning in the Arab World.* Cairo, Institute of National Planning, 15 May 1963.

A discussion of the rationale of educational planning in relation to education and national development, which brings out particular educational problems of the Arab world with which planning will have to deal.

E6503.1000 Regional Centre for the Advanced Training of Educational Personnel in the Arab States. *Qa'imah bibliografiyah bi-aham al-maraje' al-arabiyah al-khasah bil-takhit al-tarbawi.* Beirut, 1963.

A bibliographical list of the more important Arabic publications on educational planning held at the Centre.

E6503.1020 *Centre Regional de Formation des Cadres Superieurs de l'Enseignement dans les Etats Arabes.* Beirut, 1962-63.

The Centre's programme, containing a bibliography in the English, French and Arabic languages.

E6503.1040 *Centre Regional de Formation des Cadres Superieurs de l'Enseignement dans les Etats Arabes.* Beirut, 1962.

This is the programme of the Centre, indicating the content of its courses and recommended readings.

Egypt

E6504.0060 Abdel-Rahman, I.H. "Comprehensive Economic Planning in the UAR," *Etude Mensuelle sur l'Economie et les Finances de la Syrie et des Pays Arabes,* 6eme Annee, No. 67. (juillet 1963), 25-61.

The article discusses the UAR National Plan 1960-1965, which sets the planning of education and other social services in the context of the plan for economic development.

E6504.0080 al-Jawhari, Zaki M. *Takhtit al-ta Lim wa idad al-Quwa al-Bashariyah fi Khitat al-Tanmiyah al-Iqtisadiyah wa al Ijtima Iyah.* Cairo, Ministry of Education, 1963.

E6504.1000 United Arab Republic. Documentation and Research Centre for Education. *Takhtit al-ta Lim Bil-Jumhuriyah al-Arabiyah al-Muttahidah.* Educational Planning in the UAR. Cairo, 1962.

A brief summary of the efforts of the Ministry of Education of the UAR in educational planning.

E6504.1060 United Arab Republic. Ministry of Education, Documentation and Research Centre for Education. *Bibliography of Educational Planning in the United Arab Republic,* n.d.

A list of annotated entries of official UAR publications on educational planning.

E6504.1080 United Arab Republic, Ministry of Education. *Educational Planning in the United Arab Republic.* Cairo, Ministry of Education, 1962.

A description of educational planning efforts in the UAR under the Five-Year Educational Plan, 1960-1965. (M. Blaug)

E6504.1100 United Arab Republic. Central Ministry of Education. *Adwa fi Takhtit al-Mashru at al-ta Limiyah wa-al-Tarbawiyah.* On the Planning of Educational Projects. Cairo, 1960.

A guide to educational planning, dealing with the steps of the planning process and the subject matter of planning.

E6504.1200 Fahmy, M.S. and Weheba, S. *A Note on Estimates of Teacher Requirements for the Period 1965-85 by Level and Branch of Education.* Memo. No. 349. Cairo, Institute of National Planning, 29 June 1963.

The methodology and results of estimates of the demand for and supply of teachers in relation to the long-term educational plan for UAR. (See studies by Rofail, S. in section DI.)

E6504.1220 Fahmy, M.S. and Weheba, S. *A Note on First Attempts for Estimating Expenditures on Education for the Period 1965-85.* Cairo, Institute of National Planning, 28 May 1963.

The methodology and results of expenditure estimates made in conjunction with the long-term educational plan for UAR. (See studies by Rofail, S. in section DI).

E6504.1400 Hasan Mostafa. *al Takhit al-am Lil ta' lm wa-i dad al-mu al Limen fi al-Jumhuriyah al-Arabiyah al-Muttahidah.* General Planning of Education and Teacher Training in UAR. Cairo, Institute of National Planning, 1961.

An exposition with full statistical tables of the main principles of educational planning in UAR for all levels of education and for teacher-training. The period 1959-1960 – 1969-1970 is covered.

E6504.1800 Mustapha, Hassan. *Educational Planning and Teacher Training.* Cairo, United Arab Republic Institute of National Planning, 1961.

Part 1 is concerned with a review of educational progress between 1953 and 1960 which includes most of the period of the first 5-year plan begun in 1956, and the relation of this to the provisions of the record 5-year plan begun in 1959. Then the first year's progress of the second plan is considered, and proposals for policy changes to permit fulfillment of the plan are made. Part 2 is a more detailed exposition of the second 5-year plan's provisions.

E6504.2000 Pant, Pitambar. *Economic and Social Development, Manpower Planning and Education.* Cairo, Institute of National Planning, January 1962.

In a wide-ranging discussion the author urges the role of educational and manpower planning as agencies to overcome bottlenecks in national development.

E6504.2100 Rofail, S. *et al. Estimates for Cost of Proposed Education Plan for the Period 1960-1985.* Cairo, Institute of National Planning, 27 May 1963.

The methodology and results of costing exercises undertaken in conjunction with the long-term educational plan for UAR. (See studies by Rofail, S. in section DI.)

E6504.2120 Rofail, S. *et al. Long-Term Manpower Planning Research.* Cairo, Institute of National Planning, 1963.

The paper gives results of exercises to determine (1) the pattern of labour requirements; (2) the output of the educational system; (3) changes consequently needed in plan targets or the educational structure to match (1) and (2), for the UAR during the period 1960-1985.

E6504.2140 Rofail, S. *et al. Proposed Education Plan to Match Manpower Requirements for the Period 1960-1985.* Cairo, Institute of National Planning. 25 May 1963.

This plan shows the expansion of the UAR education system required to satisfy the estimated long-term manpower requirements of the economy.

Israel

E6505.0100 Bank of Israel. "Investment in Education and Human Capital in Israel," *Bank of Israel Bulletin,* No. 23 (March 1965), 3-27.

Presents estimates of the stock of education embodied in the Israeli labor force in 1961-1963 and annual investments in education in Israel since 1948. (M. Blaug)

E6505.0400 Grunfeld, Y. "The Measurement of Educational Capital in Israel," *Fifth Report 1959 and 1960.* The Falk Project for Economic Research in Israel. Jerusalem, FPERI, 1961, 146-150.

Preliminary results of a study which reveals a sharp fall in the per capita stock of educational capital in 1951 due to an increase in immigration from Asia and Africa. (M. Blaug)

E6505.0800 Klinov-Malul, R. *The Profitability of Investment in Education in Israel.* Jerusalem, The Maurice Falk Institute for Economic Research in Israel, 1966.

Calculates the present value of the net returns to years of schooling in Israel in 1957 at various discount rates, after making allowance for country of origin and length of residence, but not for native ability. Comparisons are drawn with the United States, and the returns to doctors, lawyers, engineers, and accountants are separately calculated. (M. Blaug)

E6505.0820 Klinov-Malul, R. "Profitability of Investment in Education," *Fifth Report 1959 and 1960.* The Falk Project for Economic Research in Israel. Jerusalem, FPERI, 1961, p. 138-146.

Preliminary results of a study based on a random sample of Israel households. The findings about the rate of return at various levels of education are particularly interesting owing to the relatively low proportion of persons in Israel with primary education and an extremely high proportion with secondary and higher education. (M. Blaug)

Iran

E6506.0100 Blandy, R. and Nashat, M. "The Education Corps in Iran: A Survey of its Social and Economic Aspects," *International Labor Review,* (May 1966), 521-530.

The authors describe the activities of the special army corps of teachers in Iran, created in 1963 to spread literacy in rural areas using the principles of the 'community school', and give a favorable assessment of its effectiveness. (M. Blaug)

E6506.0800 Iran, Ministry of Education. *20-Year Proposed Plan for Universal, Compulsory and Free Primary Education in Iran (The First Five Years Phase).* Tehran, Ministry of Education, 1962.

A summary of requirements of teaching personnel and finance during the first five years of a 20-year plan to provide a universal and compulsory free 8-year education in Iran. It is not clear how far the plan relates to development needs or to what extent Iran can afford to carry it out unaided.

E6506.0900 Jacobs, N. *The Sociology of Development: Iran as an Asian Case Study.* Praeger Special Studies in International Economics and Development. New York, F.A. Praeger, 1966.

A brief discussion of the relation between education and occupation in Iran. (M. Blaug)

Jordan

E6507.0400 International Bank for Reconstruction and Development. *The Economic Development of Jordan.* Report by the IBRD. Baltimore, The Johns Hopkins Press, 1957.

A brief description of education in Jordan, followed by a series of policy recommendations. (M. Blaug)

Morocco

E6508.0800 Morocco, Ministere de l'Education Nationale. *Plan Quinquennal, 1960-1964.* Rabat. Ministere de l'Education Nationale, 1 juin 1960. Tome I, 'Politique Scolaire'. Tome II, 'Evaluations Budgetaires'. n.d.

A detailed plan for the development of all sections of the Moroccan educational system. A drawback of the plan is that it is not clearly set in the context of national economic development, though fostering of this is one of its declared aims. Hence the viability of the plan needs to be established.

Syria

E6509.0100 Brucher, Felix J. *Vocational Agricultural Education in Developing Countries; General Remarks and the Programme in the Syrian Arab Republic.* Damascus, The Ford Foundation, September 1962.

The author relates the development of agricultural education to rural economic development, and follows this with a detailed critical discussion of Syrian provisions for agricultural education. In advocating the allocation of administrative responsibility for agricultural education to the agricultural authorities, he leaves the problem this raises of fitting agricultural education into educational planning activities unanswered.

Tunisia

E6510.0500 Khoi, L.T. "Sur l'Interet d'une Presentation Fonctionnelle du Budget de l'Education Nationale: la Tunisie," *Tiers-Monde. Problemes des Pays Sous-Developpes.* (avril-juin, 1965), 463-479.

An analysis of the structure of Tunisia's educational budget. (M. Blaug)

Turkey

E6511.0100 Blum, J. "Planning Models for the Calculation of Educational Requirements for Economic Development, Turkey," *Econometric Models of Education, Some Applications,* Paris, Organization for Economic Cooperation and Development, 1965, Part III, 55-76.

This paper presents various applications of the macro-models for educational planning described in part I. These models were developed in order to study some quantitative problems in adapting education to the economic development of a country. They are theoretical in nature and were not developed with any specific country in mind. This paper describes an experiment in which Turkey was chosen as a typical example of a country to which these models could be applied in order to test their general efficacy as practical instruments for educational planning. It is hoped that the results of such experiments will determine the practical usefulness of macro-models and show the best method of reformulating them for successful application to other countries.

E6511.1500 Sarc, Omar Celal. "Education in Countries in Process of Development: Experience of Turkey." Paper given at the International Economic Association Conference on the Economics of Education, Menthon St. Bernard, 29 August - 7 September, 1963.

A brief description of the educational system in Turkey, with indications of some of the particular problems faced, the degree of success in overcoming them, and consequent proposals for modification of the educational system.

E6511.2000 Turkey. State Planning Organization. Social Planning Department. *Development and Economy in Educational Planning.* Tome I. 1966.

E6511.2020 Turkey. State Planning Organization, Social Planning Department. *Development and Economy in Educational Building.* Report Tome II. 1966.

E6511.2040 Turkey. State Planning Organization, Social Planning Department. *Development and Economy in Educational Building.* Report Appendix I. "Provincial, Regional and National Tabulations of the Cost Analysis of Existing Primary Schools," 1966.

E6511.2060 Turkey. State Planning Organization, Social Planning Department. *Development and Economy in Educational Building.* Report, Appendix III. "A Model Study for a New Approach to the School Building Problem," 1966.

OTHER

Canada

E6603.0100 Bertram, G.W. *The Contribution of Education to Economic Growth.* Staff Study No. 12. Economic Council of Canada. Ottawa, Canada, Queen's Printer, 1966.

An important study applying the Denison-method of calculating the 'sources of growth' to Canada. At various points, and especially in chapter 2, ingenious comparisons are made in the level of educational attainments between Canada and the United States. Among the technical appendices, App. B-7, B-8, and B-9 are particularly recommended. (M. Blaug)

E6603.0400 Economic Council of Canada, Second Annual Review. *Towards Sustained and Balanced Economic Growth.* Ottawa, Queen's Printer, 1965.

Chapter 4, pp. 71-97, of this annual review is devoted to the topic of education and Canadian economic growth, and compares the mean years of schooling and the rates of return on investment in education in Canada and the United States. (M. Blaug)

E6603.1500 Podoluk, J.R. *Earnings and Education.* (Advance Release from Census Monograph, *Incomes of Canadians*). Dominion Bureau of Statistics, Central Research and Development Staff. Ottawa, Queen's Printer and Controller of Stationery, 1965.

This study analyzes the earnings of the Canadian labor force by age, sex, occupation, and years of schooling, and calculates the present value of the earnings by years of schooling, net of the costs of education, at various discount rates. Includes some comparisons with recent United States findings. (M. Blaug)

E6603.1600 Robinson, A.J. "The Bladen Commission and Graduate Education," *Canadian Journal of Economics and Political Science,* (November 1966), 523-525.

Considers the implications of the Bladen Report on *Financing Higher Education in Canada* (1965) for graduate education, contrasting the policy of expanding Canadian graduate schools with alternative methods of providing teachers for undergraduate expansion. (M. Blaug)

E6603.2000 Wilkinson, B.W. *Some Economic Aspects of Education in Canada.* Cambridge, Mass., A Ph. D. Dissertation submitted to the Massachusetts Institute of Technology, Microreproduction Laboratory, M.I.T. Libraries, 1964.

In the opening chapter, the author carefully reviews all the existing approaches to assessing the economic value of education and comes down in favor of the manpower-planning approach. Chapter 2 analyzes net Canadian immigration to the United States in absolute numbers and in estimated human capital values. Chapter 3 applies a cost-benefit framework to the interchange of students between Canada and the U.S.A. Chapter 4 translates the U.S. Dictionary of Occupational Titles into an estimate of Canadian Labor requirements by occupation, using 1961 Canadian census figures. Chapter 5 analyzes employers' needs for educated manpower with the aid of multivariate analysis. The final chapter considers the rationale of occupational choices in the light of the present values of anticipated lifetime incomes in different occupations in the Canadian economy. (M. Blaug.)

E6603.2020 Wilkinson, B.W. *Studies in the Economics of Education.* Ottawa, Canada, Economics Branch, Department of Labour, Queen's Printer, 1966.

In the opening chapter, the author carefully reviews all the existing approaches to assessing the economic value of education and comes down in favor of the manpower-planning approach. Chapter 2 analyzes net Canadian immigration to the United States in absolute numbers and in estimated human capital values. Chapter 3 translates the U.S. Dictionary of Occupational Titles into an estimate of Canadian labor requirements by occupations, using 1961 Canadian census figures. (M. Blaug)

MISCELLANEOUS

E7000.0100 Anderson, C.A. "Economic Development and Post-Primary Education," *Post-Primary Education and Political and Economic Development,* eds. D.C. Piper and T. Cole. Durham, N.C., Duke University Press, 1964, 3-26.

Apart from this directly relevant essay, the volume includes a series of papers on secondary and higher education in Africa and Asia by American sociologists and political scientists. (M. Blaug)

E7000.0120 Anderson, C.A. *The Social Context of Educational Planning.* Paris, The Fundamentals of Educational Planning: A Series of Training Booklets, International Institute for Education Planning, 1964.

E7000.0140 Anderson, C.A. and Bowman, J.M., eds. *Education in the Early Stages of Economic Development.* Chicago, Ill., Chicago University Press, 1965.

This volume consists of papers presented at a conference in 1963 under the auspices of the Comparative Education Center of the University of Chicago. A few of these are reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey, Paris: UNESCO, 1964, and have been mentioned above. The complete table of contents is as follows: A. Kahan, 'Russian Scholars and Statesmen on Education as an Investment'; A. Harberger, 'Investment in Man versus Investment in Machines: The Case of India'; H. Leibenstein, 'Shortages and Surpluses in Education in Underdeveloped Countries: A Theoretical Foray'; W.L. Hansen, 'Human Capital Requirements for Educational Expansion: Teacher Shortages and Teacher Supply'; M.J. Bowman, 'From Guilds to Infant Training Industries'; R.J. Storr, 'The Growth of American Education'; P.J. Foster, 'The Vocational School Fallacy in Development Planning'; R.I. Crane, 'Technical Education and Economic Development in India Before World War I'; C.R. Wharton, 'Education and Agricultural Growth: The Role of Education in Early Stage Agriculture'; F.H. Harbison, 'The Prime Movers in Innovation'; T. Hagerstrand, 'Quantitative Techniques for Analysis of the Spread of Information and Technology'; S. Rottenberg, 'The International Exchange of Knowledge'; A. Kahan, 'The "Hereditary Workers" Hypothesis and the Development of a Factory Labor Force in 18th and 19th Century Russia' and 'Determinants of the Incidence of Literacy in Rural 19th Century Russia'; R. Blitz, 'Some Observations Concerning the Chilean Educational System and its Relation to Economic Growth'; C.A. Anderson, 'Patterns and Variability in the Distribution and Diffusion of Schooling' and 'The Educational Preconditions of Development:

Notes from History'; A. Kahan, 'Social Structure, Public Policy, and the Development of Education and the Economy in Czarist Russia'; W.H.G. Armytage, 'The Interrelation Between Economic Growth and Developments in Education in England 1588-1805'; H. Passin, 'Portents of Modernity and the Meiji Emergence'; and R. Easterlin, 'Some Notes Concerning the Evidence of History'. (M. Blaug)

E7000.0200 Bowen, William G. *Economic Aspects of Education, Three Essays.* Research Report Number 104. Princeton, N.J., Industrial Relations Section, Princeton University, 1964.

E7000.0220 Brazer, H.E. and David, M.H. "Social and Economic Determinants of the Demand for Education," *Economics of Higher Education,* ed. S.J. Mushkin. Washington, D.C., Government Printing Office, 1962, 21-43.

A nation-wide probability sample of spending units in the U.S.A. in 1960 yields the firmest evidence we yet have of the intergeneration effect in the demand for education: Children of more educated parents attain more than average education, even after allowing for the better economic situation of the family. (M. Blaug)

E7000.0300 Chakravarty, S. "An Outline of a Method for Programme Education," P.M. Rosenstein Rodan (ed.), *Capital Formation and Economic Development.* London, George Allen and Unwin, 1964.

E7000.0340 Coleman, J.S., *et al. Equality of Educational Opportunity.* U.S. Department of Health, Education, and Welfare. Washington, D.C., Government Printing Office, 1966.

A comprehensive account of regional and racial differences in the distribution of educational resources in the U.S., with a study of the influence of school and home environment on pupil achievement. The effects of school desegregation programmes on Negro and white pupils are examined in detail. (M. Blaug)

E7000.0500 Eckaus, R.S. "Economic Criteria for Education and Training," *Review of Economics and Statistics,* Vol. 46, No. 2 (May 1964), 181-190.

E7000.0520 Evans, R.M. *Sociometry and Education.* London, Routledge & Kegan, Paul, 1962.

E7000.0600 Friedman, John. "Intellectuals in Developing Societies," *Kyklos,* Vol. XIII, (Fasc. 4, 1960), 513-41.

A sociological study treating economic development as a process of social transformation and asking what is the role of intellectuals, and hence one part of education, in this process.

E7000.0700 Ginzberg, E. and Bray, D.W. *The Uneducated.* New York, Columbia University Press, 1953.

This valuable study moves from a review of educational developments in America to a review of the facts about illiteracy discovered during World War II. The second section of the book presents a unique body of case materials designed to reveal the ability of the poorly educated to perform effectively in a military organization once they have acquired literacy. Ch. 9 deals with the experience of southern industry in employing the uneducated. Ch. 10 treats of uneducated migrants. The book concludes with a plea for Federal assistance to the poorer states to help them improve their educational systems. (M. Blaug)

E7000.0720 Greenwood, Frank. University of Georgia, "Education for Systems Analysis: Part I," *Systems and Procedures Journal,* (January-February 1966), 13-15.

Although accredited business schools can offer adequate computer training they cannot be expected to turn out expert programmers and finished systems analysts. Only on-the-job experience can produce real professionalism. Knowledge of the business–to the extent needed to design overall EDP systems–cannot be acquired under a minimum of four or five years. These two facts suggest that systems analysts should be recruited from the ranks of programmers. Also, this practice would give programmers a future beyond more complex coding. An alternative is to hire inexperienced, recent college graduates and train them by a series of different assignments. Systems analysts who have not come through the ranks of the computing jobs need some training in EDP, enough to be able to make estimates of critical cost items. In addition, the trainee-analyst should have some knowledge of manual and mechanical approaches to business systems.

E7000.0800 Harbison, Frederick. *The Prime Movers of Innovation.* Paper given at the Conference on Education and Economic Development, Chicago, Committee on Economic Growth, Social Science Research Council, 1963.

Discusses the importance of innovators in economic development and the educational policies needed to produce them.

E7000.0840 Harris, S.E. *More Resources for Education.* New York, Harper & Bros., 1960.

A series of lectures, touching on the income elasticity of expenditures on education, the issue of productivity, teachers' salaries, and the pros and cons of federal aid. (M. Blaug)

E7000.0860 Harris, S.E. and Levensohn, A. *Education and Public Policy.* Berkeley, Calif., McCutchan Publishing Corp., 1965.

This volume is the third of a series based on seminars given at Harvard. Among the 16 papers, the following deserve special mention: P.H. Coombs and D. Riesman in educational planning, pp. 99-113; F. Bowles on college admissions in different countries, pp. 167-178; J.A. Kershaw on productivity measurement in schools and colleges, pp. 185-192; J.C. Estey and H. Goldthorpe on Student aid in American higher education, pp. 253-276; H. Rosen and J. Dunlop on the Manpower Development and Training Act, pp. 301-308; and E.F. Denison, R.M. Solow, and O. Eckstein on Denison's *Sources of Economic Growth,* pp. 327-342. There is a discussion of 'Womanpower and Education' pp. 317-327, and an introduction by S.E. Harris, commenting on all the papers in this volume (pp. 1-15), and summaries by A. Levensohn of the discussions at each seminar. (M. Blaug)

E7000.0880 Harris, S.E., Deitch, K.M. and Levensohn, A. eds. *Challenge and Change in American Education.* Berkeley, Calif., McCutchan Publishing Corp., 1965.

This volume is drawn from papers and discussions at a seminar held at Harvard University Graduate School of

Public Administration in 1961-1962. Among the 16 papers, the following deserve special mention: M. Yudelman and A. Curle on the Karachi, Addis Ababa and Santiago Plans, pp. 103-112; C.S. Benson on solutions for the teacher shortage in the United States, pp. 169-174; H.S. Conrad on differential financial aid to university students by subject of specialization, pp. 177-180; O. Eckstein on state and local investment in education, pp. 189-194; and A. Daniere attacking rate-of-return analysis of educational investment, pp. 205-220. There is an introduction by S.E. Harris, commenting on all the papers in this volume pp. 1-37. K.N. Deitch contributes an excellent series of commentaries on the various sessions, summarizing and interpreting the discussions. (M. Blaug)

E7000.0900 Harris, Seymour E. (Editor). *Higher Education in the United States: The Economic Problems.* Cambridge, Massachusetts, Harvard University Press, 1960.

Though closely devoted to American experience, the papers in the sections 'Experiment in higher education' and 'Economics and educational values' could conceivably be of comparative interest for educational planners elsewhere.

E7000.0940 Hayward, B. "Student Inflow to Higher Levels of Education," Paris, OECD, 17 May 1963.

A paper outlining the various factors influencing student inflows, to point out how policies for increasing such inflows should give attention to these factors.

E7000.1000 Intrilligator, Michael and Smith, Bruce L.R. "Some Aspects of the Allocation of Scientific Effort Between Teaching and Research," *American Economic Review,* Vol. 56 (May 1966), 494-507.

Develops a model for the allocation of new scientists and identifies optimum allocations of such scientists in the light of certain science policy objectives.

E7000.1200 Kaser, M.C. "The Economic Balance of Skill and of Comfort." Paper presented to the UNESCO Conference on the Methodology of Human Resource Formation in Development Programmes, June 1963, Frascati, Italy, UNESCO, Paris, 31 May 1963.

The paper considers the objectives of measuring human resources, seeks to define education as a function of consumer demand and to classify training by end-use. It proposed definitions of 'welfare' and 'waste' in relation to human-resource formation, and separates 'intermediate' from 'investment' needs in its planning.

E7000.1400 Leibenstein, H. "Shortages and Surpluses in Education in Underdeveloped Countries–A Theoretical Foray," *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

An analysis of the factors which inhibit the clearance of labor markets, particularly the ways in which skills are labelled in underdeveloped countries. (M. Blaug)

E7000.1600 Musgrave, P.W. "Constant Factors in the Demand for Technical Education: 1860-1960," *British Journal of Educational Studies,* May 1966, 173-187.

A historical survey of public requests for increased technical education for economic or social reasons. Argues that the two main constants have been pressure of foreign competition and the work of a few prominent industrialists or educationists. See also the author's 'The Growth in the Demand for Training in the Iron and Steel Industry 1945-1964,' Vocational Aspect of Secondary and Further Education, Spring 1966, pp. 10-16. (M. Blaug)

E7000.1640 Mushkin, Selma J. *Resource Requirements and Educational Obsolescence.* Paris, Organization for Economic Cooperation and Development, 24 October 1963.

The author recognizes the need for continuous re-education of the whole labor force in a society governed by rapid technological change, and makes suggestions for appropriate educational reforms.

E7000.1660 Mushkin, S.J. "Resource Requirements and Educational Obsolescence," *International Economic Association Conference on the Economics of Education,* London, Macmillan, 1965, 463-479.

This paper advances the interesting notion of one-year sabbatical leaves with pay for everyone at some time in their working life for purposes of 'retreading'. The scheme would be financed by a 1.5 percent payroll tax shared between the government, the employer, and employees: in the United States, such a tax would provide for one year's re-education for one million people each year, not quite enough, however, to cover the whole labor force of 70 millions in less than fifty years. (M. Blaug)

E7000.2000 Organization for Economic Cooperation and Development. *Inter-Governmental Conference on the Education and Utilization of Scientific and Technical Personnel.* Paris, Directorate of Scientific Affairs, OECD, 1966.

The papers presented at this conference consisted of : (1) OECD, Manpower and Social Affairs Directorate, 'Some Aspects of the Operation of the Labour Market for Highly Qualified Personnel' (30 pp.), and (2) L. Levine, 'Placement Mechanisms for Highly Qualified Personnel in the United States' (55 pp.), both of which do little more than survey methods of hiring scientific manpower in the member-countries; (3) J.K. Wolfe, 'Continuing Education for Engineers and Scientists' (25 pp.) as exemplified in the General Electric Company in the United States; (4) H. Folk, 'The Response of Higher Education to Economic Needs, (60 pp.), a valuable comparison of American and British education for specific occupations concluding that, within the limits of circumstance, both systems of higher education have responded adequately to economic pressures; (5) E. Thorsrud, 'A Social Research Approach to the Education and Utilization of Engineers' (27 pp.), a survey of Norwegian research on career choices and job satisfaction; (6) M. Chapuy, 'Report on In-Career Training of Highly Qualified Personnel in a Major French State-Owned Concern' (29 pp.); (7) A. Page, 'Adaption of the Supply of Scientific and Technical Personnel to the Needs of the Economy: French Experience and Possible Improvements to the Information Process' (84 pp.), a detailed review of the present strengths and weaknesses of French manpower forecasting; (8) R.W. Cain, 'The Programme of Postcensal Studies of Professional and Technical Manpower in the United States' (23 pp.); (9) M. Blaug, M.H. Peston, A. Ziderman, 'The Utilization of Qualified Manpower in Industry' (65 pp.), the report of a pilot-study in the British electrical engineering industry; and (10) J.G. Orr, 'A Study of Engineering Responsibility Levels in the United Kingdom' (67 pp.). (M. Blaug)

E7000.2100 Organization for Economic Cooperation and Development. Policy Conference on *Economic Growth and Investment in Education.* Paris, OECD, 1962. (Also published in French and Spanish.)

One of the key sources in the field, containing articles on many aspects of the subject. Articles dealing specifically with particular subjects are listed separately under their authors.

E7000.2300 Parnes, Herbert S. "Relation of Occupation to Educational Qualifications," in *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, 147-57.

The article examines the relation of occupation to educational qualification, illustrating its frequent tenuousness, and concluding that a cautious approach is accordingly required in formulating educational requirements.

E7000.2500 Rashid, M. *Absorption of the Educated.* Paper given at the International Economic Association Conference on the Economics of Education, Menthon St. Bernard, 29 August - 7 September 1963.

The paper discusses the commonly associated phenomena of unemployed intellectuals and scarcity of skilled labor, and suggests that educational planners should take account of the character of the labor market, particularly when planning for the higher levels of education. Social factors affecting employment must also be considered.

E7000.2700 Smith, D.C. "Children's Books in Developing Countries," *International Development Review,* Vol. V, No. 1 (March 1963), 17-20.

This brief article stresses the educational importance of publishing relevant juvenile books in developing countries, and of providing an adequate school library service as a chief market for such books.

E7000.2900 Stoikov, V. "The Allocation of Scientific Effort: Some Important Aspects," *Quarterly Journal of Economics,* (May 1964), 307-324.

This paper analyzes the optimum allocation of scientists and engineers between teaching and research so as to maximize the magnitude of research findings produced in a given period of time. Surprisingly enough, it is shown that an optimal allocation over the next ten or twenty years requires that the fraction of graduating scientists and engineers teaching in the U.S.A. be increased considerably. (M. Blaug)

E7000.3500 Van Den Haag, E. *Education as an Industry.* N.Y., Augustus M. Kelley, 1956.

An early and non-quantitative contribution to the concept of human capital, concluding with an outline of a scheme whereby colleges would invest in the education of their students, taking a share of their future income. The difficulties in such a plan are not squarely faced. (M. Blaug)

E7000.3700 Wilson, Thomas J., *et al. Books and Economic Development.* Paper E/CONF. 39/K/87, 9 November 1962, at the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, 1962.

It is worth considering how far the subject of this paper, book production, is the concern of the educational planner.

GOVERNMENT

Administration

G000.0050 American Political Science Association. *Papers Delivered at the 1966 Annual Meeting.* Washington, 1966.

Partial contents. (No. 3) The Impact of Analysis on Bargaining in Government, by William M. Capron. (No. 11) Data Requirements for Testing Systems Theories: Problems in the Measurement of Output and Allocations, by William C. Mitchell. (No. 14) Bargaining and Analysis in Government, by Henry S. Rowen.

G000.0200 Baumol, William J. "Informed Judgment, Rigorous Theory, and Public Policy," *Southern Economic Journal,* Vol. 32 (October 1966), 137-145.

G000.0250 Black, Guy. *The Application of Systems Analysis to Government Operations.* Washington, D.C., National Institute of Public Affairs, 1966.

G000.0300 Chartrand, Robert L. "The Systems Approach: A Tool for the Congress," *Extension of Remarks of the Honorable Hugh Scott. Congressional Record,* Vol. 113, (March 20, 1967), S4049-S4053.

Describes the contemporary congressional milieu with its numerous and increasing demands upon the members of congress. The systems approach is examined as an aid in handling the duties of congressmen. Applications of data processing to law-making and appropriations are discussed and the implications for relationships between the Executive and the Legislature are explored.

G000.1100 Kapp, K. William. "Economic Development, National Planning and Public Administration," *Kyklos,* Vol. XIII, Fasc. 2 (1960), 172-201.

Though written with reference to economic planning, the article emphasizes the important role of effective administrative services, particularly in the implementation of plans, and draws attention to qualitative and quantitative deficiencies of administration, using India as an example.

G000.1150 Kendrick, John W. "Summary and Evaluation of Recent Work in Measuring the Productivity of Federal Government Agencies," *Management Science,* Vol. 12 (December 1965), B120-B134.

The paper contains first a discussion of the nature and meaning of productivity index numbers. Productivity measures are viewed as ratios of output to input, in real terms. They largely reflect changes (or differences) in the technology and organization of production over time (or between similar producing units). The applicability of productivity measurement systems to Federal Government organizations is discussed. Results of the Bureau of the Budget report 'Measuring Productivity of Federal Government Organizations' are summarized. While the report covers only 5 Federal, civilian organizations, the author concludes that productivity measurement could usefully be extended to most other civilian agencies, and to some functions of the Department of Defense, particularly in the supply and maintenance areas.

G000.1700 McClenon, P. R. *Should We Make the Government More Businesslike?* P-2695. The

RAND Corp., Santa Monica, Calif., January, 1963.

An examination of accounting and management techniques which have been suggested for use in making government management more businesslike. It is observed that the utility of some business techniques is quite limited in government. For one thing, resources can be used only as authorized by Congress. Also, Managers' salaries in government are notoriously less than those available to successful business managers. It is proposed that efforts be directed toward improving personal incentives for resource management.

G000.1720 McKean, R. N. *Divergences between Individual and Total Costs with Government.* P-2818. The RAND Corporation, Santa Monica, California, November 1963.

A study of the contrast between attitudes toward the private and public portions of the economy; namely, the difference between costs and rewards as perceived by decision-makers, and total costs and rewards produced by their actions. These differences are often called external economies or diseconomies of spillover effects; they affect other people in ways not usually taken into account by managers or other individuals who take action. The effect of the function of these differences in government operations is presented.

G000.1740 McKean, R. N. *Efficiency in Government Through Systems Analysis.* New York, John Wiley & Sons, Inc., 1958.

General methodological problems of analyzing alternative actions are discussed, with illustrations taken from various activities, such as business, military planning and water resource development. Attention is given to the devising of criteria, the selection of alternatives, the treatment of intangibles, uncertainty and the methods of taking time streams into account. Special problems in the analysis of water resource projects are discussed. Major topics include the criterion questions arising from this particular application of analysis and the difficulties of measurement or evaluation. An examination is also made of the potential use of analysis to increase efficiency in other government activities. The book discusses virtually all of the ways that error has been found to be introduced into cost-benefit studies. The defining of intangible benefits and costs in terms of tangible values, the dangers in using the benefit/cost ratio, the results of inadvertently considering costly inputs as free, discounting for the nonsimultaneity of costs and benefits, ways to deal with uncertainty, and the dangers of double-counting are clearly and thoroughly discussed. Checklists and examples are provided.

G000.2000 Ross, Donald H. *Administration for Adaptability.* New York, Columbia University Press, 1951.

G000.2500 Smithies, A. *Government Decision-Making and the Theory of Choice.* P-2960. The RAND Corporation, Santa Monica, California, October 1964.

A discussion of government decision-making and the allocation of scarce resources among alternative uses. The study focuses on the decision-making process at the higher levels of government as exemplified in the high-level problem of optimizing the entire defense program in the allocation of a given budget for defense.

G000.2600 Terleckyj, Nestor E. "Measurement of Output of Federal Government Programs." Lecture at the U.S. Naval Postgraduate School, Monterey, California, October 29, 1965. Washington, D.C., Bureau of the Budget, 1965.

G2000.2700 Tiebout, Charles M., "An Economic Theory of Fiscal Decentralization," *Public Finances: Needs, Sources and Utilization,* Universities-National Bureau for Economic Research. Princeton University Press, 1961, P. 79-96.

Fiscal Federalism involves the relations of multilevel governments. A normative approach may take the political structure as given and then see what economic consequences result. Conversely, one may neutralize political variables and arrange governments solely on the basis of economic efficiency.

This paper is concerned with fiscal federalism–fiscal decentralization–purely from the point of view of economic efficiency. Alternatively stated, the problem is defined such that–as nearly as possible–political federalism is neutral. This framework can be varied as alternative forms of political federalism come under consideration as discussed by Richard Musgrave in this volume. (Author)

G000.3000 U.S. Bureau of the Budget. *Measuring Productivity of Federal Government Organizations.* Washington, D.C., U.S. Government Printing Office, 1964.

G000.3100 U.S. Congress. House Committee on Government Operations. *Systems Development and Management,* Hearings before a subcommittee...87th Congress, 2nd Session, Washington, D.C., Government Printing Office, 1962.

Testimony of Charles J. Hitch, Assistant Secretary of Defense (Comptroller), p. 513-547; Appx. IV (B), p. 643-644.

G000.3200 U.S. Congress. Joint Committee on the Organization of the Congress. *Organization of the Congress.* Hearings. 89th Congress, 1st Session, Washington, D.C., Government Printing Office, 1965. Part 12. p. 1775-1783. (Statement by Charles L. Schultze, Director, Bureau of the Budget.)

In his statement before the Joint Committee, Schultze poses several questions concerning Congressional action on the budget: (1) do appropriations committees have available the information important to matters of "program choices", (2) can greater consistency be achieved between various appropriations bills in view of the increasing number of multi-agency programs; (3) can Congress maintain harmony among its committees without burdening the Executive Branch with an annually expiring or biennially expiring authorization system?

In connection with those questions Schultze outlines the present efforts of the Executive Branch toward extending the Planning-Programming-Budgeting System into each department and agency. The purpose of PPBS is "to have a system which will provide the kind of specific information and analysis on the basis of which both Congress and the Executive can make better choices of where and how to allocate budgetary resources." The four elements of the system are: (1) definition of program objectives; (2) development of indicators or measures of effectiveness; (3) comparison of alternative ways; (4) placement of these three elements into a proper framework.

Budgeting

G010.0100 Anshen, M. *The Federal Budget as an Instrument for Analysis, Planning and Management.* RM-4512-RC. The RAND Corporation, Santa Monica, California, April 1965.

A discussion of existing and proposed federal budgetary procedures, covering such subjects as major uses of the federal budget, problems in allocating resources at the national level, characteristics of a useful budget structure, and deficiencies in the present federal budget.

G010.0120 Anshen, Melvin, "The Federal Budget as an Instrument for Management and Analysis," *Program Budgeting, Program Analysis and the Federal Budget,* ed. by David Novick, Cambridge, Mass., Harvard University Press, 1965, p. 3-23.

The lead-off article is a summary of the actual budgetary process with associated problems and a potential program budgetary process with it strengths and weaknesses.

G010.0250 Brite, George. *The Federal Budget Process.* Washington, D.C., Legislative Reference Service, Library of Congress, September 26, 1966.

G010.0300 Chase, Samuel B., Jr. *Problems in Public Expenditure Analysis.* Washington, D.C., Brookings Institution, 1967.

G010.0340 Committee for Economic Development. *Budgeting for National Objectives.* New York, Committee for Economic Development, January 1966.

G010.2000 McKean, R. N. *Criteria of Efficiency in Government Expenditures.* P-1180-RC. The RAND Corporation, Santa Monica, California, September 1957.

A discussion of the criteria problems involved in choosing efficient government programs. The inevitability of breaking problems into administratively manageable subproblems and the consequent danger of applying inconsistent criteria are explained. Common criteria errors and how they can be guarded against are discussed.

G010.2040 McKean, Roland N. *Operations Research and Government Budgets.* P-999-C. The RAND Corporation, Santa Monica, California, 1957.

The techniques of operations research may be employed to seek an improved allocation of funds among programs or to seek the best size of particular programs; (i.e.) to compare, not only alternative ways to carry out a specified activity, but also alternative scales of that activity or alternative allocations of resources among activities. Uses the program of the Forest Service as an example.

G010.2200 Novick, D. *Efficiency and Economy in Government Through New Budgeting and Accounting Procedures.* R-254. The RAND Corporation, Santa Monica, California, February 1954. (DDC No. AD-116 589).

Proposes a new method of budgeting and accounting for the Federal Government, with special reference to the military departments and to the Air Force in particular. In the use of systems analysis for Air Force problems it has been necessary to consider not only weapon effectiveness – the usual end objective – but also the resource cost of alternative weapon systems. Existing Air Force financial accounting and cost accounting systems, however, did not provide the required information. Cost analysis studies indicated that a relatively simple but fundamental change in expenditure classifications used for budget proposals, appropriation acts, and federal financial accounting would provide the desired information and could be accomplished within the provisions of the Budget and Accounting Procedures Act of 1950 and Title IV of the Amendments to the National Security Act of 1947. The introduction of the proposed uniform classification of accounts would provide accurate and consistent information for planning, programming, budgeting, operating and review purposes.

G010.2240 Novick, D. *The Federal Budget as an Economic Document.* Hearings Before the Sub-Committee on Economic Statistics of the Joint Economic Committee, Congress of the United States, April 23-30, 1963.

This statement contains a discussion of the improvements on the form of the federal budget that would be needed to evaluate its economic impact. The existing budget arrangement is not considered to be useful as an economic document. The principle reasons for the deficiency are described as (1) the lack of an 'end-product' or 'activity' oriented format, (2) too much of an administrative or organizational orientation, (3) the time span covered is too short, (4) insufficient distinction between one-time investments and recurring operating outlays, and (5) budget concepts and language that are too complicated.

G010.2280 Novick, David. *The Federal Budget as an Indicator of Government Intentions and the Implications of Intentions.* P-1803. The RAND Corporation, Santa Monica, California, October 1959.

An examination of the budget structure as it existed in the 1950's from the standpoint of how well it indicated intentions of the government and the implications of these intentions. It is shown that this purpose of the budget is essentially synonymous with that aspect of the budgetary process associated with making major resource allocation decisions. In such a context, the budget structure was found deficient in several major respects. These deficiencies provide the basis for various suggestions on how the budget format might be improved.

G010.2320 Novick, D. and Fisher, G. H. "The Federal Budget as a Business Indicator," *Harvard Business Review,* Vol. 38, No. 3 (May-June 1960), 64-72.

Presents a description of the form of the federal budget and its usefulness as an indicator of the Government's plans and objectives. The need for improvement is considered. Recommendations include (1) a format that provides identification of end-product activities and their associated resources, (2) an extended time horizon, (3) a more clear-cut distinction among outlays for investment, operations, and research, and (4) that the budget not be burdened with administrative considerations, funding concepts, and jargon. A proposed format is presented, patterned after the Department of Defense program budgeting structure.

G010.2500 Peacock, Alan T. and Hauser, Gerald. (eds.) *Government Finance and Economic Development.* Papers and proceedings of the Third

Study Conference on Problems of Economic Development, Athens, 12-20 December 1963. Paris, OECD, May 1965.

An attempt has been made in this publication to give a systematic analysis of the present state of knowledge on budget policy and its application to the problems of the developing countries.

G010.2600 Rowen, Henry S. *Improving Decision Making in Government.* Talk at a meeting of the Budget Bureau's Summer Seminar on Systems Analysis and Program Evaluation, August 19, 1965. Washington, D.C., Bureau of the Budget, 1965.

Discusses budgeting-by-objective and the use of systems cost analysis to optimize budgeting decisions. Useful examples are provided.

G010.2900 Samuelson, Paul A. "Aspects of Public Expenditure Theories," *Review of Economics and Statistics,* Vol. 40 (November 1958), 332-338.

Considers some of the difficulties of expenditure theory and political decision-making.

G010.2980 Samuelson, Paul A. "The Pure Theory of Public Expenditure," *Review of Economics and Statistics,* Vol. 36 (November, 1954), 387-389.

See also Comment by Julius Margolis in *Review of Economics and Statistics,* Vol. 37 (November 1955) 347-349.

G010.3100 Stein, Herbert. *Evaluation of a Federal Program.* New York, Committee for Economic Development, 1966.

CED has made many helpful comments and analyses about the size of the federal budget in general about procedures for making budget decisions more rational. It has, however, studied few specific spending programs to a point where it could say it thought they were effective and worthwhile or whether they had been properly set up and were being well managed. What we learn about a specific program or two might well lead to valuable future statements about budgetary matters.

G010.4000 U.S. Congress, *Economic Report of the President, Hearings.* 84th Congress, 1st Session, January 1956.

G010.4100 U.S. Congress, House Committee on Interior and Insular Affairs. *Discussion of Budget Bureau Circular A-47 and the Related Power Partnership Principle, Hearings.* 84th Congress, 1st Session, March 15 and 30, 1955.

G010.4200 U.S. Congress. Joint Economic Committee. *Economy and Efficiency in Government Expenditures.* Federal expenditure policy for economic growth and stability papers submitted by panelists appearing before the Subcommittee on Fiscal Policy. Washington, D.C., Government Printing Office, 1957, p. 221-263.

Contents.–Some devices for increasing efficiency in Government expenditures, by O.H. Brownlee.–Economy and efficiency in Government expenditures, by Albert G. Buehler.–Interest rate in cost-benefit analysis, by Arnold C. Harberger.–Economy in Government spending: the concept, by C. Lowell Harriss.–Criteria of efficiency in Government expenditure, by Roland N. McKean.

G010.4300 U.S. Congress. Joint Economic Committee. *Fiscal Policy Issues of the Coming Decade, Hearings* . . . 89th Congress, 1st Session, Washington, D.C., Government Printing Office, 1965.

Testimony of Budget Director Schultze, p. 62-87.

G010.8000 Wildavsky, Aaron. *The Politics of the Budgetary Process.* Boston, Mass., Little, Brown, and Co., 1964.

This book reports the results of an investigation into the actual budgeting process in Washington and is extremely useful to the cost-benefit analyst in understanding the political environment of which his work is a part.

PPBS

G020.0100 Anshen, M. *The Program Budget in Operation.* RM-4691-RC. The RAND Corporation, Santa Monica, California, August 1965.

This memorandum examines some of the implications of the operation of the program budget for organizations and individuals whose work would be affected by it. It considers the potential contributions of the process to more realistic planning, issues to be resolved if a program budget structure is put into operation within the existing federal organizational structure, the need for expanding and strengthening analytical activities at various levels, the possible impact on planning and budgeting at state and local government levels, and the implications for private management and economic research activities.

G020.0120 Anshen, Melvin, "The Program Budget in Operation," *Program Budgeting, Program Analysis and the Federal Budget,* ed. by David Novick. Cambridge, Mass., Harvard University Press, 1965, p. 353-370.

The author discusses the implications of a fully implemented program budget. This is treated in a context of the potential impact on Federal, state and local governments, and industry.

G020.0200 Banks, Robert L. and Kotz, Arnold. "The Program Budget and the Interest Rate for Public Investment," "Planning-Programming-Budgeting System: A Symposium," *Public Administration Review,* Vol. XXVI, No. 4 (December 1966), 283-291.

G020.0300 Chartrand, Robert L. and Brezina, Dennis W. *The Planning-Programming-Budgeting System: An Annotated Bibliography.* Washington, D.C., Library of Congress Legislative Reference Service, April 11, 1967.

The items in this paper have been included in our bibliography.

G020.0340 Committee for Economic Development. *Budgeting for National Objectives; Executive and Congressional Roles in Program Planning and Performance. A Statement on National Policy by the Research and Policy Committee.* New York, CED, 1966.

Consists of a policy statement prepared by the CED Committee for the improvement of Management in Government.

the budget is considered in two aspects, as follows: as a focus for national policy decisions and as a tool for effective management. A continuous unified system for planning, programming, and budgeting is discussed. The program budgeting system of the DOD ic considered, together with a recommendation for the application of its concepts throughout the government. Allied analytical techniques such as cost-benefit and cost-effectiveness analysis are described.

Goals, objectives, programs: preparation of the executive budget, p. 23-40.

G020.0780 Hirsch, Werner Z. "Toward Federal Program Budgeting" in "Planning-Programming-Budgeting System: A Symposium." *Public Administration Review,* Vol. XXVI, No. 4 (December 1966) 259-270.

G020.0800 Greenhouse, Samuel M. "The Planning-Programming Budgeting System: Rationale, Language, and Idea-Relationships," in "Planning-Programming-Budgeting System: A Symposium," *Public Administration Review,* Vol. XXVI, No. 4 (December 1966), 271-276.

The author makes two points in this succinct article. First, a single concept forms the base of the PPBS structure. The PPBS concept is that each Federal Agency is accountable to the President for the production of goods and services, and more particularly, for the distribution of these goods and services to the American people. This is a departure, the author maintains, from the previous purpose of the budget system which was to provide the Presidency with administrative support.

Second, key terms, which are common in analytical and budgeting circles, have different meanings in the PPBS context. The author proceeds to define and explain eight terms that are vital elements of the new systems. These are: objectives, programs, program alternatives, outputs, progress measurements, inputs, alternatives, and systems analysis.

G020.0900 Held, Virginia. "PPBS comestto Washington," *The Public Interest,* No. 4, (Summer 1966), 102-115.

G020.0940 Hirsch, Werner Z. *Integrating View of Federal Program Budgeting.* RM-4799-RC. The RAND Corp., Santa Monica, California. 1965.

The major objective of the memorandum is to propose an overall budget format for use in planning. Appropriation, administration, and control within the entire federal establishment. Program budgeting can aid in the preparation of operationally meaningful information on inputs and outputs, by paying due regard to policy objectives, costs, and time discussions. A program is a cluster of government activities that are in closer competition with each other than those outside the program and whose output has a clearly identifiable purpose. It ties together various interdependent activities that enter into the output and about which decisions need to be made. For certain purposes it is useful to consider that the federal government is concerned with five major decision areas–maintenance of national security, maintenance of law and order, social development, and general government operations.

G020.0960 Hirsch, Werner Z. *Toward Federal Program Budgeting.* P-3306. The RAND Corporation, Santa Monica, California, February 1966. (DDC No. AD-628 095).

It is proposed that program budgeting in the federal government will allow key management functions to be carried out which are not now possible under our present administrative budgeting system; that it can provide formal ways of regularly evaluating alternatives; of stimulating marginal trade-offs among resources; of identifying problem areas; of generating improved management and investment strategies and procedures; of formulating planning and operating theories; and of defining information requirements. In order to make these contributions, program budgeting attempts to make explicit the relationship between direct outputs of programs (patients treated, youngsters educated, missiles produced, etc.) and the nation's more profound objectives and purposes. Some basic concepts of program budgeting are presented, an example of a federal program budget is developed, applications discussed, and problems and prospects of implementation are examined.

G020.1200 Lazarus, Steven. "Planning-Programming-Budgeting Systems and Project PRIME," *Defense Industry Bulletin,* Vol. 3. No. 1 (January 1967) 1-4.

The purpose of this article is to place PPBS in perspective by briefly describing its historical antecedents in DOD; outlining the process as it was implemented and refined from 1961 to 1965; and, most importantly, describing the changes which are being made in it in DOD under the collective name of Project PRIME. (Author)

G020.1300 McGilvery, Francis E. "A Management Accounts Structure." In "Planning-Programming-Budgeting System: A Symposium," *Public Administration Review,* Vol. XXVI, No. 4 (December 1966), 277-282.

G020.1340 McKean, R. N. *Program Budgeting: Potential Difficulties and Ways of Alleviating Them.* RM-4310-RC. The RAND Corporation, Santa Monica, Calif., October 1964. (DDC No. AD-608 610).

This memorandum represents one chapter in a forthcoming book, *Program Budgeting: Program Analysis and the Federal Budget,* which is now being written. The book will focus primarily on the major issues involved in determining specific national program goals and the analytical approach necessary to facilitate decision-making on these issues. Its purpose is to help improve the understanding, and accelerate the application, of the principles of program budgeting. The objectives in view are: (1) to make the budget a more useful and precise instrument for planning, appropriation, and administration and control within the federal establishment; (2) to contribute to broader public understanding of the allocation and use of federal funds; and (3) to facilitate economic analysis, forecasting, and planning in the private sector.

G020.1360 McKean, Roland N. and Anshen, Melvin., "Limitations, Risks, and Problems," *Program Budgeting, Program Analysis and the Federal Budget,* ed. David Novick. Cambridge, Mass., Harvard University Press, 1965, p. 285-307.

The problems that are likely to occur when program budgeting is introduced are dealt with by the authors. These problems fall into three broad categories–conceptual, operational, and institutional.

The very meaning of program budgeting will present difficulties. Is it (1) restructuring of the budget where costs are accumulated into more meaningful categories: (2) a budget that implies a longer planning horizon; (3) an adaptation of analytical tools, such as cost utility and

operations research, to the budgeting process; or (4) an arrangement for enforcing the allocation decisions?

Operational problems, those related to managerial implementation, could be of many sorts; (1) the difficulty of collecting and organizing the appropriate information; (2) the improper fit of the program budget into the budgetary process. The old budget structure will probably exist alongside the new for some time providing a potential for conflict between the two structures; (3) the centralization of authority by including a mechanism for enforcing central decisions. Decision-making could drift upward. Alternative solutions could be suppressed. Alternative studies could become 'design studies;' (4) by increasing the rationality required in decision-making, a conservative bias might develop. Decision makers will be reluctant to take chances or rely on their institutions; (5) the lack of concern for uncertainties because they cannot be treated rationally. A procrustean approach to decision-making might occur.

Institutional problems are related to those pressures, bureaucratic or political, that are unavoidingly present, in any organizational setting. To many of the interests represented by the executive, legislative and private sectors, the program budget will be seen as a disturbance 'if not an outright threat.'

G020.1380 McKean, R. N. and Anshen, M. *Problems, Limitations, and Risks of the Program Budget.* RM-4377-RC. The RAND Corporation, Santa Monica, California, January 1965.

This memorandum studies potential disadvantages that must be considered whenever improved program budgeting arrangements are introduced. Progressive redesign of innovations is recommended to cut costs and increase gains. The authors note that excessive centralization could lead to loss of flexibility, neglect of alternatives, and failure to take uncertainties into account. Diversity rather than uniformity is needed in program budgeting.

G020.1400 New York State. Division of the Budget and Office for Regional Development. *Guidelines for Integrated Planning-Programming-Budgeting.* March 1966.

G020.1440 Novick, David, "The Department of Defense," *Program Budgeting, Program Analysis and the Federal Budget,* ed. by David Novick, Cambridge, Mass., Harvard University Press, 1965, p. 81-119.

The author paints in the historical background to program budgeting by discussing its introduction in the Department of Defense.

G020.1460 Novick, David. *Origin and History of Program Budgeting.* P-3427. The RAND Corporation, Santa Monica, California, October 1966.

Consists of a transcription of a presentation for instruction sponsored by the federal government for training in the Planning-Programming-Budgeting System. The origins of program budgeting in the federal government are traced back to the War Production Board in 1942. As early as 1924, elements of program budgeting were contained in General Motor's Budget and Finance Procedures. The discussion in this paper deals primarily with the history of program budgeting in the federal government. The Controlled Materials Plan is described as the first program budget used in the federal government. Early RAND activities in systems analysis that led to a proposal for program budgeting in 1953 are discussed.

G020.1480 Novick, David (ed.) *Program Budgeting, Program Analysis and the Federal Budget.* Cambridge, Harvard University Press, 1965.

In the preface Novick emphasizes the need for program budgeting due to the complexities of resource allocation decisions. Program budgeting is designed to perfect or sharpen decision-making by improving the methods of framing problems and increasing the quantity, quality and organization of information available.

In view of limited resources, the central problem is to assure that a program's resource requirements can be reasonably met in the future as well as the present. While the allocation process is primarily a political one, new methods and techniques can illuminate the implications and ramifications of decisions to be made. Program budgeting provides such an approach.

The book is divided into three sections. Part I discusses the government's decision-making process and the role of budgeting in the process. Part II describes the development of the program budgeting techniques in the Department of Defense and presents possible approaches to other government functions. Part III deals with the implementation and operation of the program budget. The twelve articles and essays contained in the book are listed below. One or two sentence descriptions are included for eight of them; longer descriptions are provided for the other four.

G020.1500 Novick, D. *Which Program Do We Mean in "Program Budgeting?"* P-530. The RAND Corp., Santa Monica, Calif., May 1954. (DDC No. AD 422 827). Also published in *Armed Forces Management Association NEWSLETTER,* Vol. 1, No. 6 (August-September 1954), 7-18.

The need for program budgeting and its advantages in the administration of the federal budget are discussed in this paper. The development of the concept of programs is described as originating from the needs of the War Production Board during World War II. A program is defined as a set of related tasks or resources necessary to carry out an end-object. The federal budget in most cases does not reflect programs; managers cannot use the budget as an administrative and control instrument; and Congress cannot review the budget in the light of the objectives of most agencies. A program is the sum of the steps or interdependent activities that contribute to the attainment of a specified objective and is budgeted in terms of all elements necessary to its execution.

G020.1700 "Planning-Programming-Budgeting System: A Symposium," *Public Administration Review,* Vol. XXVI, No. 4, December 1966.

The December issue of the *Public Administration Review* features a symposium on the new management system which the civilian agencies of the Federal government have adopted recently. The series consists of six articles on the subject.

G020.1900 Schick, Allen. "The Road to PPBS: The Stages of Budget Reform," in "Planning-Programming-Budgeting System: A Symposium," *Public Administration Review,* Vol. XXVI, No. 4 (December 1966), 243-258.

The author examines and carefully weighs the question, How does the new budgeting system differ from the old? As a follow-up, he asks, What is the significance of this difference? Three distinct stages of budgetary reform are discussed in order to provide an historical perspective on the recent changes in the budgetary process, viz., the introduction of PPBS.

The concepts of control, management, and planning identify the three stages. The first stage dated roughly from 1920 to 1935 and emphasized the development of an adequate system of expenditure control. Although management and planning elements were present, the first priority was to establish a reliable system of expenditure accounts. The second stage with a management orientation emerged during the New Deal and culminated in the movement for performance budgeting. The third and present stage stresses integrating the planning and budgeting functions of government. PPBS was first developed and refined in the Department of Defense. Because of its success the President directed that it be adopted by all Federal civilian agencies.

The author admits that the two previous orientations–control and management–continue to influence the budgetary process and act as constraints on budget reform. Yet, PPBS is designed to alter the form in which information is categorized, affecting the actions of budget makers. Systems analysis and the cost-benefit approach is stressed. In this connection a new group of professionals are being brought into budgeting. They are committed to the types of analysis and norms required by the new techniques and have a background in economics and systems analysis rather than in general administrative training.

G020.1940 Smithies, Arthur., "Conceptual Framework for the Program Budget," *Program Budgeting, Program Analysis and the Federal Budget,* ed. by David Novick. Cambridge, Mass., Harvard University Press, 1965, p. 24-60.

Smithies declares that society benefits in a direct proportion to the amount of information available on the implications of political decisions. He further believes that a government can determine its policies most effectively if it chooses rationally among alternative courses of action, with as full a knowledge as possible of the implications of those alternatives. He considers that planning, programming, and budgeting provides the necessary tools to do this. PPBS constitutes the process by which objectives, resources and their interrelations are taken into account to achieve a coherent and comprehensive program.

Several factors increase the difficulties of program designing and include: (1) problem of highly complex or vague objectives; (2) possibility of a multi-agency program as opposed to a single agency program; (3) contradiction over functional versus some other method of programming, e.g., regional programming as the State Department might desire; (4) necessity for considering both public and private interests in programs aimed at economic development.

Smithies suggests certain criteria that should be met when designing programs. The criteria should (1) permit comparison of alternative methods for carrying out the objectives; (2) consist of complementary components; (3) place service supplying elements of an organization in a separate program; (4) provide for overlapping structures in organizations where geographical and functional programs are required; (5) separate programs according to time span over which expenditures take effect. For example, functions may be divided into production, investment, and research and development

G020.1960 Smithies, A. *A Conceptual Framework for the Program Budget.* RM-4271-RC. The RAND Corporation, Santa Monica, California, September 1964.

This memorandum, in presenting a conceptual framework for program budgeting, outlines the government decision-making process and the role of budgeting in it, examines techniques of program budgeting, and considers possible problems of organization and administration.

G020.1980 Steiner, George A. *Problems in Implementing Program Budgeting.* RM-4514-RC. The RAND Corporation, Santa Monica, California, August 1965. Also in *Program Budgeting, Program Analysis and the Federal Budget,* ed. by David Novick. Cambridge, Harvard University Press, 1965, p. 308-352.

This memorandum is concerned with problems of implementing program budgeting throughout the Federal Government. It deals principally with major barriers existing in the Congress and in the Executive Branch, rather than with problems of detailed operations.

The broader problems arising from the implementation of program budgeting are discussed. The article addressed the question, 'How fast and in what depth shall program budgeting be further used in the Federal Government?' Included is a diagram of a system for comprehensive planning.

G020.2000 Steiner, George. "Program Budgeting: Business Contribution to Government Management," *Business Horizons,* Vol. 8 (Spring 1965), 43-52.

Brief, non-technical survey of the elements of the program budget and the analytical approach to choosing among alternative courses of action.

G020.2020 Sussna, Edward. "Planning, Programming, and Budgeting Systems–A New Approach to Government Spending," *Pittsburgh Business Review,* Vol. 37, No. 5 (May 1967), 7.

An informal description of the governmental planning-programming-budgeting system.

G020.2300 "DOD Program Budget Structure and the Budget Process," Special Annex to *USAF Industrial Newsletter,* No. 85, January 1964.

The Air Force portion of the Department of Defense programming, budget, and financial structure is described in this article. The program budgeting system is discussed and compared with the conventional budget process. The purposes and operation of the system, in terms of its contribution to the decision-making process, are examined. A distinction in decision-making is drawn between decisions to develop systems and decisions on force composition and force levels.

G020.3000 U.S. Bureau of the Budget. *Planning-Programming-Budgeting.* Washington, D. C., 1966.

G020.3100 U.S. Bureau of the Budget. *Planning-Programming-Budgeting.* Bulletin No. 66-3. Washington, D.C., October 12, 1965.

The bulletin describes procedural steps for establishing and implementing the planning, programming and budgeting system. The background, concepts and structure of PPBS are discussed. Agency responsibility is spelled out in broad terms. A schedule is included requiring the agencies to submit multi-year programs and plans by May 1, 1966.

G020.3150 U.S. Bureau of the Budget. *Planning-Programming-Budgeting.* Supplement to Bulletin No. 66-3. Washington, D.C., February 21, 1966.

The supplement describes the procedures for filling out and submitting two of the documents central to PPBS–

Program and Financial Plans (PFP) and Program Memoranda (PM). The PFP is a tabulation of program outputs, in the form of services or hardware, and program inputs, in the form of costs and other financial data. The Program Memorandum is to be prepared annually on each of the program categories shown in the PFP. The PM provides the analytic backup to the individual program. These memoranda are to serve as basic planning documents. They are periodically updated on the basis of new information, shifting objectives, or changing availability or resources. Both documents are to be submitted for the first time by May 1, 1966 and will form the basis of the spring review of the budget.

G020.3200 U.S. Bureau of the Budget. *Planning-Programming-Budgeting (PPB).* Bulletin No. 68-2. Washington, D.C., July 18, 1967.

This bulletin replaced Bulletin 66-3 (reviewed above) and does not differ in general purpose from that bulletin.

G020.3215 U.S. Bureau of the Census. *Performance Review for Operating Programs.* Financial Management System Series/FMSS-1. Washington, D.C., n.d.

Performance Review for Operating Programs, (PROP), is a management information system developed by the Bureau of the Census. It is both a planning and a reporting medium which uses electronic data processing for recording, compiling, and summarizing information. This booklet describes the development, mechanics, and applications of PROP.

G020.3250 U.S. Department of the Air Force. *Program Budget Control.* Washington, D.C., June 1962.

Describes the Department of Defense program budget control system. The system is designed for continuous decision-making on major programs. Its objective is described as the integration of planning, programming, and financial management into a current "Five-Year Force and Financial Program." The major features of the system are (1) a program financial base structured on the DOD-wide mission, (2) a formal system of changes to the financial base, and (3) progress reporting of both financial and nonfinancial data against approved milestones.

G020.3300 U.S. Office of Economic Opportunity. *Establishing of the Planning-Programming-Budgeting System.* OEO Instruction No. 72-2. Washington, D.C., July 16, 1966.

The instruction establishes PPBS in the Office of Economic Opportunity and incorporates the requirements outlined in Bureau of the Budget Bulletin 66-3 and its supplement. It opens the way for implementing program budgeting procedures by supplying the essential background, assignments or responsibilities, definition of terms, and an explanation of procedures and reports. The report is divided into eight sections:

1. Introduction
2. Assignment of system responsibilities
3. System end products
4. The annual budget plan and the annual operating plan
5. Threshold change procedures
6. The program structure
7. The ideal PPBS cycle
8. Glossary of terms.

G020.4000 Weidenbaum, Murray L. *Program Budgeting: Applying Economic Analysis to Government Expenditure Decisions.* St. Louis, Washington University, Dept. of Economics Working Papers, 1966. Also in *Business and Government Review,* Vol. 7 (July-Aug. 1966), 22-31.

G020.4040 Weisskopf, William M. *A Study into the Origins and Nature of Performance and Program Budgeting.* Monterey, Calif., Naval Postgraduate School. (Master's Thesis). May 1962. (DDC No. AD-482 296).

A distinction has been made between program and performance budgeting. Performance budgets never existed as such. There have been budgets that permitted the measurement of performance but these are properly described as cost-based budgets. They are dependent on a product that has measureable output. That is, they can only be used when it is possible to measure activity output in some concrete terms. It is also necessary that the output be directly and completely related to the amount budgeted. It has been shown that this type of budget will not measure the performance of a defense activity. However, it was shown that the program contribution of a defense activity could be measured.

This measurement was termed program performance, a type of performance which informs top management of the actual program costs for defense. While this is a very limited form of performance, it is the only real financial measurement available.

Taxation

G030.0200 Brownlee, O. H., "User Prices vs. Taxes," *Public Finances: Needs, Sources and Utilization.* Universities-National Bureau for Economic Research. Princeton, N. J., Princeton University Press, 1961, p. 421-437.

Although I favor using price as a rationing device wherever a reasonable opportunity exists, I believe that the appropriate area for application of market pricing to the determination of how much of various goods and services government should produce is a relatively small one. Opportunities undoubtedly exist for financing such items as fire and police protection partially on the basis of service actually rendered. Nevertheless, such cases would be relatively insignificant in terms of the over-all pattern of public expenditure. I see few *major* services that ought to be financed exclusively from sales revenue that are not already being financed in this way. However, the criteria currently used for establishing prices and for determining how much to produce are not necessarily the best ones. Furthermore, charges at less than cost might well be established for some services that are now provided free.

My criteria for evaluating whether a service is being rationed appropriately and whether the amount produced is optimal do not include the effects upon the distribution of income. If agreement could be reached with respect to how various income distributions should be ordered, the best one could be achieved independently of the production pattern of government services. (Author)

G030.0800 Hawaii. Department of Taxation, Tax Research and Planning Office. *Comparative Effects of the Governor's Tax Proposals and Those of the Governor's Advisory Committee on Finance and Taxation,* February 1965.

G030.0820 Hawaii. Department of Taxation, Tax Research and Planning Office. *Effect of Exempting Food Products and Medical Care from the General Excise Tax.* December 14, 1965.

G030.0830 Hawaii. Department of Taxation, Tax Research and Planning Office. *Effect of Land Taxation on Large Holdings.* Unpublished, April 1965.

G030.0840 Hawaii. Department of Taxation, Tax Research and Planning Office. *Effectiveness of Tax Relief for Natural Disaster Victims--Updated to December 31, 1964.* March 1965.

G030.1000 Lindblom, Charles E. "Decision-Making in Taxation and Expenditures," in *Public Finances: Needs, Sources and Utilization.* Universities-National Bureau for Economic Research. Princeton, N. J., Princeton University Press, 1961, p. 295-336.

One of the standard complaints about present practice is the separation in time and attention between the authorizing legislation and the appropriations legislations. A major barrier to bringing the two together may be the conventional insistence on the inclusion of all appropriations decisions in the budgetary process. The effect of my proposals is to get appropriations out of the present budgetary process so that in a feasible way appropriations can be linked very tightly to basic legislation. Granted that this line of prescription for the budgetary process flies in the face of a sustained movement toward increasing dependence on the budget as a major coordinating instrument, no one has yet made a convincing case that the budgetary process is today an effective and rational coordinator; it has largely been assumed to be so. It is quite possible that the present line of budgetary reform, which goes back at least as far as the Taft administration, was suited to the much smaller government programs of earlier years. But when the Department of Defense alone uses roughly a tenth of the national product, when it spends more than the national product of some nations, when it purchases forty times as many products as marketed by Sears Roebuck, it is no longer safe to assume that the budgetary problem is still basically the same old problem. Without raising any questions about budgeting within agencies, I suggest in short that comprehensive budgeting for the American government may be a prerevolutionary method of programming the expenditures of a government that has indeed gone through a revolution in its size, complexity, and involvement with citizens' values. (Author)

G030.2000 Turvey, Ralph. "On Divergences Between Social Cost and Private Cost," *Economica,* Vol. 30, (August 1963), 309-313.

Illustrates the uselessness of general prescription of a tax as a means of dealing with external diseconomies.

State Local Government

G100.0200 Baltimore. Commission on Governmental Efficiency and Economy. *Program for A Mayor, A Course of Action for Achieving Greater Efficiency and Economy in Baltimore's City Government.* Baltimore Commission on Governmental Efficiency and Economy, Baltimore, Maryland, 1959.

This report makes recommendations in the following areas: Official Appointments; Metropolitan Viewpoint; Revenue Structure; Taxable Basis; Long Range Planning and Programming; Capital Improvements; Capital Funds; Scope of Functions; Key to Economy; Controlling Costs; Performance Audits; Budgeting; Personnel; Employee Unions; Employees' Retirement System; Schools; Welfare; City Hospitals; Recreation; Gold; Stadium; Markets; Free Public Baths; Contingent Fund; Purchasing; Office Equipment; Lease-Maintenance Plans; Prison Labor; Performance Specifications; Economy of Design; Transportation; Street Cleaning; Paving Repairs; and Asphalt Plant.

G100.0250 Baltimore. Commission of Governmental Efficiency and Economy, Inc. *Program for the New City Administration. Actions Designed to Provide More Effective and Less Costly Municipal Government.* Baltimore, Maryland, May 1963.

The Commission, through its studies and bulletins, has offered many practical suggestions for improving municipal operating and management practices. Some recommendations wholly or partially adopted are reflected in savings that have been accomplished by alert and cost-conscious officials. Much more could have been accomplished and further savings achieved if more of these recommendations had been effected by the City.

In the following portion of this report, the Commission is offering suggestions for carrying out a program for greater efficiency and economy in the Municipal Government. Some of the suggestions presented herein are short range and could be implemented immediately, others are long range and some may even require legislation. Past reports and YOUR TAX DOLLAR bulletins have dealt with certain of these subjects in detail.

In April 1959 this Commission presented a PROGRAM FOR A MAYOR to achieve greater efficiency and economy in Baltimore City Government. That program is expanded and brought up to date in this current presentation. (Author)

G100.0300 California. *Conversions to the Programming and Budgeting System.* Department of Finance Management Memorandum No. 66-14, May 17, 1966.

G100.0350 California. *Programming and Budgeting System.* Governor's Directive, May 16, 1966.

G100.0400 Committee for Economic Development. *Modernizing Local Government.* New York, CED, July 1966.

G100.0800 Emanuel, H. and Weitenberg, J. *Forecasting the State's Expenditure; A Way to Serve the Needs of Both Budget Management and Economic Planning.* Paper presented at the Second International Workshop on Problems of Budget Policy and Management in Developing Countries. Copenhagen, September 4-16, 1967.

G100.0900 Folsom, Marion B. *Improving State Government.* New York, Committee for Economic Development, 1966.

This statement will consider reforms to overcome major weaknesses in legislative and executive organization of state governments. Presently, the majority of states limit their legislatures to short-term biennial session, and most legislators are paid little and given little or no secretarial and research assistance. In most states the governor's term is two years while the few (14) with four-year terms prohibit a governor from succeeding himself. Most governors do not have the authority to act as strong executives because of their short terms and because department heads are elected separately and board or commission members have long overlapping appointive terms.

G100.1000 Gruen, Claude. *Systems Analysis Applied to the Problems of Local Urban Governments.*

A paper presented at the session on Local Government at the 1966 meeting of the Institute of Management Sciences. Pleasantville, N. Y., 1966.

G100.1100 Hatry, Harry P. and Cotton, John F. "Program Planning for State, County, City." State-Local Project of the George Washington University, Washington, D.C., January 1967.

This paper is divided into two sections: A description of programming-planning-budgeting systems and a presentation of analytical techniques useful in the application of PPBS to practical problems. It would be possible to use this paper to initiate a PPBS of rather sophisticated design.

G100.1120 Hawaii. Management Services Division, Department of Budget and Finance. *Management Guide on How to Implement the State-wide Information System for the State of Hawaii.* December 1963.

G100.1140 Hawaii. Management Services Division, Department of Budget and Finance. *Report on a Study to Determine the Feasibility of Contracting for Certain Building and Maintenance Shop Services of the University of Hawaii,* February 1965.

G100.1160 Hawaii. Management Services Division, Department of Budget and Finance. *Study of Organization and Functions of State Government Agencies for Honolulu Civic Center Planning,* September 1964.

G100.1200 Hirsch, Werner Z. "Local versus Areawide Government Services," *National Tax Journal,* Vol. 17 (December 1964), 331-339.

Discusses the formulation of criteria to determine which government services are better performed on a local and which on an areawide basis and which of the services that favor local operations should be given subsidies by higher levels of government.

G100.1220 Hirsch, Werner Z. (ed.) *Regional Accounts for Policy Decisions.* Papers presented at the Conference on Regional Accounts, Miami Beach, Florida, 1964. Baltimore, Johns Hopkins Press, 1966.

G100.1300 Issacs, Herbert H. *SDC Documents Applicable to State and Local Government Problems.* Systems Development Corp., Santa Monica, California, 11 August 1964.

This document contains a selective list of SDC publications available to external requesters. The documents on this list were selected on the basis of their general or specific applicability to current problems of state and local government. Work of a more basic research nature has been omitted. This list is organized by substantive categories and alphabetically by author within each category. The categories include: The administration of justice, biomedical systems, computer program systems, the development and management of computer-based systems, education and training information retrieval, simulation in experimentation, and urban information systems.

G100.1400 Kegan, Lawrence. *Federal-State-Local Fiscal Relations.* New York, Committee for Economic Development, 1966.

This statement will deal with the problem of what should be done by state and local governments to increase their fiscal authority and responsibility so that they can meet the rapidly growing demand for services best performed at the state and local levels. The statement also will review the role that the federal government tax and grant program might play to support such efforts.

G100.1450 Kibbee, Joel M. *SDC Documents Applicable to State and Local Government Problems.* Systems Development Corporation, Santa Monica, California, 16 February 1965.

A selective list is presented of SDC publications available to external requesters. The list is organized by substantive categories and alphabetically by author within each category. The categories include the administration of justice, bio-medical systems, computer program systems, development of computer-based systems, education and training, information retrieval, simulation in experimentation, and urban information system.

G100.1500 Labovitz, I. M. and Ecker-Racz, L. L., "Practical Solutions to Financial Problems Created by the Multilevel Political Structure," *Public Finances: Needs, Sources and Utilization.* Universities-National Bureau for Economic Research. Princeton, N. J., Princeton University Press, 1961. pp. 135-227.

This paper examines ways and means of increasing the financial capabilities of state governments through adjustments in federal-state-local fiscal relations. Federalism, to be sure, creates problems at the federal level as well, but these do not relate primarily to fiscal capability. In a sense our primary concern is for the financial capabilities of local governments, since much of the initial impact of rising civilian governmental costs is on them. However, cities, countries, towns and school districts are the wards of the states and their problems the states' problems. (Author)

G100.1550 Lichfield, N. and Margolis, J. "Benefit-cost Analysis as a Tool in Urban Government Decision-making," *Public Expenditures Decisions in the Urban Community.* Washington, D.C., Resources for the Future; distributed by Johns Hopkins Press, 1963.

G100.1590 Musgrave, Richard A. "Approaches to A Fiscal Theory of Political Federalism," *Public Finances: Needs, Sources and Utilization.* A Conference of the Universities-National Bureau for Economic Research. Princeton, New Jersey, Princeton University Press, 1961, p. 97-133.

When independent states join in a federation, they may do so to develop a common foreign defense, or establish a customs union, or they may wish to pursue certain objectives which require central government interference in the finances of the member states. It is this interference which is the subject of this paper. (Author)

G100.1600 Mushkin, Selma J. *Planning, Programming, Budgeting for City, State, County Objectives.* State-Local Finances Project, George Washington University, 5 documents, 1967.

The State-Local Finances Project of George Washington University, under the direction of Selma J. Mushkin,

prepared a series of documents on the planning-programming-budgeting system for State and local governments. The first of the series introduces the concept by discussing the purpose, history, characteristics, and components of the new budgetary system. Exhibits have been used to illustrate a PPBS program structure and a multi-year program and financial plan.

1. PPBS Note 1–Is an integrated planning, programming, budgeting system useful for our jurisdiction?
2. PPBS Note 2--Administrative framework for establishing planning-programming-budgeting systems in states, cities, and counties: some considerations are suggested possibilities.
3. PPBS Note 3–Development of initial instructions to inaugurate a planning-programming-budgeting system: some preliminary considerations and model instruction to be adapted for local use.
4. PPBS Note 4–Staffing and training for a PPB system in state and local governments.

G100.1620 Mushkin, Selma J. *State Programming and Economic Development.* Comments by W. Lee Hansen. Council of State Governments Publication RM-379. Chicago, 1965.

Defines the purposes of State economic programming and describes the tools available to carry out these purposes. Economic programming is suggested as a tool for inducing economic growth.

G100.1640 Mushkin, Selma J. and Adams, Robert F. "Emerging Patterns of Federalism," *National Tax Journal,* Vol. 19 (September 1966), 225-247.

Discusses criteria for evaluating the structure of Federal aid to State and local governments.

G100.1700 Netzer, Dick. "Financial Needs and Resources Over the Next Decade: State and Local Governments," *Public Finances: Needs, Sources and Utilization,* Universities-National Bureau for Economic Research. Princeton, N. J., Princeton University Press, 1961, p. 23-77.

This paper constitutes a considerably revised version of a preliminary exploration of the same subject which was presented at the December 1957 meeting of the American Economic Association in Philadelphia. The basic approach remains the same: in both papers I have eschewed global methods of making projections related to assumed trends in GNP, population, and the like. Rather, each expenditure and receipt category in the Census classification of state-local government finance has been examined separately and individual projections developed on the basis of uniform economic and population assumptions. (Author)

G100.1750 State of New York, Executive Department, Office of Planning Coordination, Division of the Budget. *Guidelines for Integrated Planning, Programming, Budgeting.* 1967.

Over the past thirty years the state of New York has experienced substantial increase in population growth accompanied by even greater increase in urban development throughout the state. During this same period economic growth and individual prosperity, fostered in large part by rapid technological developments, have generated additional resources and needs for new public services. Rising levels of expectations among currently deprived groups have led to organized demands for state help in problem areas heretofore considered the sole responsibility of local governments, quasi-public institutions, or private enterprise. In response to these rapid and diverse changes the role of state government has been broadened in an attempt to meet these many new needs.

This emergent role of State government has brought about recognition of the need for a carefully conceived planning process which can provide an overview of State programs and State development problems and opportunities; a process which will assist in seeking out new programs to meet newly identified needs and to deal with recognized needs in a more effective fashion.

Since 1964 the state of New York has been attempting to cope more effectively with the increasing complexities of government through the development of a planning-programming-budgeting system (PPBS) which systematically relates the expenditure of funds to the accomplishment of planned goals. (Author)

G100.2200 Seastone, Don and Hartman, L. M. "Resource Transfers and Economic Externalities in the Public Sector," To be published in *Proceedings,* National Tax Association.

The impact of differential regional growth rates upon the provision of state and local public services is studied and the attendant implications for tax policy is explored. For illustrative purposes, the disparate economic performances of ten counties in Colorado that experienced economic growth were used. The criteria employed for the economic analyses were water transfer, the complimentary shift of mobile resources, and unemployment of immobile resources, and the resultant differential income changes in the respective counties.

G100.2240 State Local Finances Project. *Planning Programming Budgeting for City, State, County Objectives.* "What is PPB?"; "PPB Note 1"; "PPB Note 2"; "PPB Note 3". The George Washington University, Washington, D.C., n.d.

This is a complete and detailed do-it-yourself kit for the planning-programming-budgeting efforts of state and local government.

G100.2300 Tiebout, C. M. "A Pure Theory of Local Expenditures," *Journal of Political Economy,* (October 1956), 416-425.

The economic case for local operation and finance of social services based on the notion that services provided by local rather than by central governments furnish an element of consumer choice by virtue of the freedom to choose residence. See also the author's 'An Economic Theory of Fiscal Decentralization,' *Public Finances: Needs, Sources, Utilization,* ed. J. M. Buchanan. Princeton, N. J., Princeton University Press, 1961, pp. 79-96, and "Comments" by J. A. Weisbrod, pp. 131-132. (M. Blaug)

G100.2320 Trinkl, F. H. "An Integrated Planning-Programming-Budgeting System for State and Local Governments." Draft Paper. Washington, D.C., State-Local Finances Project, George Washington University, March 3, 1966.

This paper describes the Federal PPBS for government bureaus, outlines a PPBS for state and local governments, and describes the benefits that are to be expected from such systems.

G100.2340 Trinkl, F. H., "An Integrated Planning-Programming- Budgeting System for State and Local Governments," *State and Local Finances Project.* George Washington University, Washing-

ton, D.C., July 1966.

G100.2800 U.S. Advisory Commission of Intergovernmental Relations. *Metropolitan Social and Economic Disparities: Implications for Intergovernmental Relations in Central Cities and Suburbs.* Washington, D.C., Government Printing Office, 1965.

Costs and benefits of metropolitan wide services, p. 56-84; Use of cost-benefit studies in allocating costs for areawide services, p. 129-131; State and Federal standards of measurement of costs and benefits and assignment of costs among local jurisdiction, p. 131-133.

G100.2840 U.S. Advisory Commission on Intergovernmental Relations. *Performance of Urban Functions: Local and Areawide.* Washington, D.C., Government Printing Office, 1963.

Economic criteria for allocation of urban functions, p. 42-50.

G100.3000 Williams, Alan. "The Optimal Provision of Public Goods in a System of Local Government," *Journal of Political Economy,* Vol. 74 (February 1966), 18-33.

Develops a model illustrating the interdependence among decision-making sectors of governmental units and concludes that the complex interactions that occur even in highly simplified situations make it impossible to predict a priori whether oversupply or undersupply will generally result.

R & D Programs

G200.0100 Aziz, U. *Investment in Rubber Research and Its Consequences.* Kuala Lumpur, University of Malaya, n.d.

G200.0300 Carey, William D. *Decision on Research and Development: Viewpoint from the Bureau of the Budget.* Denver, Colo., Denver Research Institute, University of Denver, 1966.

G200.0400 Daubin, S. C. "The Allocation of Development Funds," *Naval Research Logistics Quarterly,* September 1958.

G200.0700 Grossfield, K. and Heath, J. B. "The Benefit and Cost of Government Support for Research and Development: A Case Study," *Economic Journal,* Vol. 76 (September 1966), 537-549.

An attempt to develop a quantitative assessment of prospective social benefits of Government support of innovation, using as an example the support given by the National Research Development Corporation to the development of a potato harvester.

G200.1000 National Academy of Sciences, Washington, D.C. *Basic Research and National Goals; A Report to the Committee on Science and Astronautics, U.S. House of Representatives.* Washington, D.C., U.S. Government Printing Office, 1965.

Fifteen papers consider two issues: the allocation of resources between science and other activities and the allocation of resources within science.

G200.1040 Nekola, Jiri, and Riha, Ladislav. *The Problem of Efficiency (Cost-Benefit Analysis) of Research and Development.* Prague, Czechoslovakia, Prague Institute for the Planning of Science, Czechoslovak Academy of Science, n.d.

G200.1100 Noah, J. W. *Identifying and Estimating R & D Costs: Quiz, Problems, and Possible Solutions.* RM-3067-PR. The RAND Corp., Santa Monica, Calif., (Supplement), May 1962. (DDC No. AD 283-795).

Presents problems for testing the reader's or student's ability to analyze and apply the cost estimating techniques presented in the basic memorandum. Possible solutions to the quiz and problems with attendant explanations, graphs, and tabulations are included.

G200.1140 Novick, D. *Identifying R & D--A Management Problem.* P-2135. The RAND Corporation, Santa Monica, Calif., December 1960. (DDC No. AD 224301).

The nature and interrelationships of decisions in research and development, investment and operations are described in this paper. The historical growth of R & D is shown and with it the increase in the proportion of R & D costs to the total cost of systems. As research increases, the term itself is used so widely that measurement of R & D activity becomes difficult. The four R & D phases are offered as a basis for classifying research efforts.

G200.1160 Novick, D. What Do We Mean by "Research and Development"? The RAND Corporation, Santa Monica, Calif., October 1960. Also published in *California Managment Review,* Vol. 2, No. 3 (Spring 1960), 9-24.

The successive stages of research and development are outlined and described. Measuring R & D effort is difficult without a suitable classification system. A four-step system is suggested: Step I includes Basic Research; Step II includes Applied Research, Advanced Development, Basic Evaluation and Basic Testing; Step III includes Product Development, Product Testing, Product Evaluation and Pilot Production; and Step IV includes Product Application, Application Research, Applied Testing and Application Evaluation. Research and Development expenditures are classified by the system and the relative shares in the steps are discussed.

G200.1300 Phillips, H. M. "Science and Technology in Economic Development," *International Social Science Journal,* Vol. XVIII, No. 3 (1966), 325-344.

A discussion of the problems of assessing the returns from investment in scientific research and of forecasting requirements of scientific manpower, particularly in developing countries. Argues that estimates of manpower requirements must be based on adequate information about the present stock of scientific and technical manpower. (M. Blaug)

G200.1500 Scherer, Frederick M. "Government Research and Development Programs," *Measuring Benefits of Government Investments,* Ed. Robert Dorfman. Washington, Brookings Institution, 1965, p. 12-70.

Papers presented at a conference of experts, November 7-9, 1963.

The problems of setting up cost-benefit equations are explored. Experiments are proposed that would lead to the establishment of equations and the shapes of curves used in cost-benefit analyses. Also discussed are the panel-of-experts approach, the difficulty of assessing the effects of increasing the time taken to complete a project on costs, and many of the problems that are encountered in maximizing utility functions.

G200.1600 Tybout, Richard A. (ed.). "Economics of Research and Development," *Ohio State University Conference on Economics of Research and Development,* 1962. Columbus, Ohio, Ohio State University Press, 1965.

Classification of social costs and social benefits in research and development, by Bruno Fritsch and others, pages 258-267; The allocation of research and development resources: some problems of public policy, by Richard R. Nelson, pages 288-306.

G200.1640 Tybout, Richard A. (ed.). *Economics of Research and Development.* Ohio State University Conference on Economics of Research and Development, Columbus, 1962. Columbus, Ohio, Ohio State University Press, 1965.

Classification of social costs and social benefits in research and development, by Bruno Fritsch and others, pp. 258-267; the allocation of research and development resources: some problems of public policy, by Richard R. Nelson, pp. 288-306.

G200.2000 United Nations Educational, Scientific and Cultural Organization. *The Application of Cost-Benefit Analysis in Research and Development.* Paris. (in preparation).

G200.3000 U.S. Congress. House Committee on Government Operations. *The Federal Research and Development Programs: The Decision-Making Process.* Hearings before a subcommittee . . . 89th Congress, 2nd session, Washington, D.C., Government Printing Office, 1966.

G200.3100 U.S. Congress. House. Subcommittee on Research and Technical Programs of the Committee on Government Operations. *Federal Research and Development Programs: The Decision-Making Process.* Report of the Subcommittee on Research and Technical Programs. 89th Congress, 2nd session, June 27, 1966. Washington, D.C., Government Printing Office, 1966.

The report, released in June 1966, by the Reuss Subcommittee on Research and Technical Programs, focuses on the Federal decision-making process and the achievement of national goals. Three aggressive Federal Research and Development Programs–defense, space and atomic energy–are compared with three less aggressive programs: transportation, housing and facilities, and water pollution control. Three elements of dynamic decision-making are singled out:

1. Far-sighted decision-makers and far-reaching decisions;
2. The deliberate search for new ideas and new technology; and
3. Use of systems analysis and systems engineering to handle the complex research and development problems.

In the case of *less* aggressive decision-making, three salient factors are identified:

1. Too little initiative by some program directors;
2. Inadequate Executive Office initiatives to remedy weaknesses at program level;
3. Insufficient cost-benefit comparisons made by Executive Office of competing claims to Federal R & D funds.

The report supports PPBS, with its search for alternative objectives to meet national goals, alternative ways to attain these objectives, and with its reliance on cost-benefit analysis when selecting a particular alternative. In this context the report recommends an intensification of program budgeting efforts in the research and development programs of the Federal Government.

G200.4000 Weinberg, Alvin M. "Criteria for Scientific Choice," *Minerva,* Vol. I (Winter 1963), 159-171.

Proposes guidelines for government allocation of resources to competing fields of basic science.

G200.4400 Yovits, M.C., *et al.* (ed.). *Research Program Effectiveness.* Proceedings of the Conference sponsored by the Office of Naval Research, Washington, D.C., 1965. New York, Gordon and Breach, Science Publishers, Inc., 1966.

NATIONAL ECONOMIC PLANNING

G300.0300 Churchman, C. West, "How is Planning Possible?" *Operations Research for Management.* Baltimore, Maryland, The Johns Hopkins Press, 1956.

Any kind of planning is shown to imply a value base. The possibility of including this value base explicitly in the planning itself is considered.

G300.0400 Delprat, R. *L'Interdependance et la Coherence des Niveaux Techniques dans le Developpement.* Presentes par l'IFRED a la Conference Scientifique des Nations-Unies pour l'Application de la Technique et de la Science dans l'Interet des Regions peu Developpes, Geneve, Fevrier 1963.

G300.0450 Dror, Yehezkel. "The Planning Process: A Facet Design," *Revue Internationale des Sciences Administratives,* Vol. XXIX, No. 1 (1963), 46-58.

The article represents an attempt to systematize any planning process, thus enabling its distinctive elements to be identified, and at the same time permitting its ordered evolution and administration. As such it is a useful exercise in general planning theory, to be utilized by educational planners.

G300.0700 Glennan, Thomas K. *Issues in the Choice of Development Policies.* The RAND Corporation, Santa Monica, Calif., 1965.

Describes the development process and identifies important elements of development decisions.

G300.0850 Institute of Social Studies. *Economic Planning.* Course. The Hague, Netherlands, The Institute of Social Studies, n.d.

National Economic programming and planning in developing countries.

G300.0900 "The Study and Practice of Planning" *International Social Science Journal,* Vol. XI, No. 3 (1959), 327-409.

A group of articles discussing various aspects of planning different contexts as a technique for carrying out social and economic policies.

G300.1200 Lebret, Louis-Joseph. "Analyse Des Competences Necessaires a l'Etablissement d'un Programme de Developpement et a Son Execution," *Developpement et Civilisations,* No. 9 (janvier-mars 1962), 49-61.

The author's primary concern is to indicate the requirements of high-level personnel needed by self-supporting national development programme. The place of educational planning in permitting this to be achieved receives mention.

G300.1300 Meier, G.M. (ed.). *Leading Issues in Development Economics.* New York, Oxford University Press, 1964.

These pages reprint some earlier articles, and a brief note by H. Myint on 'Investment in Social Infrastructure', together with some introductory remarks by the editor and a bibliography. (M. Blaug)

G300.1400 Moodie, Graeme C. *Government Organization and Economic Development.* Paris, Organization for Economic Co-operation and Development, April 1966.

This book deals with governmental organization and the means whereby governments might formulate and carry out their development policies more effectively. One part of this publication is devoted to "Experience of Development" and another presents "Problems in Planning Development".

G300.1500 *The OECD Observer,* Paris, Organization for Economic Co-operation and Development.

A digest for Planners and Policy Makers. Three times a year *The OECD Observer* publishes a special article of some 12 to 16 pages on the Economic Outlook, based on studies prepared by the OECD Economics and Statistics Department for the high-level Economic Policy Committee of the Organization. Previously treated as confidential and for the sole use of governments, some of this information is now made available to those concerned with economic planning and policy-making in both the public and private sectors. The analysis covers the probable trend of demand, output, trade and payments and includes statistical tables.

G300.2000 U.S. Congress. Senate Subcommittee on Intergovernmental Relations. *Criteria for Evaluation in Planning State and Local Programs.* 90th Congress, 1st Session, July 21, 1967. Washington, D.C., Government Printing Office, 1967.

This paper aims at clarifying and developing some of the fundamental concepts of the approach to governmental program planning commonly included under the term 'planning-programming-budgeting (PPB)' system. This paper represents a first attempt at identifying specific criteria (i.e., measures of effectiveness) for use in evaluating alternative proposals for programs for carrying out major state and local governmental functions.

To date there has been little written that attempts to identify specific criteria useful for government program analysis. This paper discusses the criteria problem and makes the rash attempt to identify meaningful criteria in the hope that it will stimulate further efforts both within individual governments and by professionals outside governments who are experienced in analytical techniques. The list of criteria provided here is far from being either exhaustive or definitive. It is to be emphasized that for individual program analyses, considerable effort will still need to be applied to the determination of evaluation criteria appropriate to the specific problem. The list of criteria contained in section III of this paper can be used as a starting point.

The emphasis in this paper is on nonmonetary criteria where the author feels the greatest effort is needed in state and local government program analyses. (Author)

G300.3000 Universities-National Bureau Committee for Economic Research. *The Rate and Direction of Inventive Activity: Economic and Social Factors.* A Conference of the Universities-National Bureau Committee for Economic Research and the Committee on Economic Growth of the Social Science Research Council. Princeton, N. J., Princeton University Press, 1962.

The decision-making problem in development, by Burton H. Klein, p. 477-508.

G300.4000 Zimmerman, C.I. "Importance of 'Big Picture'." American Society of Mechanical Engineers Paper-65-WA/AV-4 for meeting November 7-11, 1965.

Paper shows that there is a vital need for close cooperation between business and industry, and government; operations research and operations and systems analysis are important tools for providing inputs into kind of decision-making, required today in planning for the future.

National Economic Planning — Theory of

G310.0800 Division de Investigacion del Desarrollo Economica. *El Pensamiento Clasico.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G310.0840 Division de Investigacion del Desarrollo Economico. *El Pensamiento Neoclasico.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G310.1200 Karmiloff, G. "Soviet Economic Models, Investment Criteria, and Prices; An Analytical Review," *Kyklos,* Vol. 16 (1963), Fasc. i, 83-109.

Investment criteria, p. 96-101; The effects of mathematical analysis on economic theory, p. 101-106.

G310.1400 Marglin, Stephen A. "The Opportunity Costs of Public Investment," *Quarterly Journal*

of Economics. Vol. 77 (May 1963), 274-289.

Discusses the problems of measuring opportunity costs in order to arrive at the optimal rate of investment.

G310.2000 Sanders, Martin. "A Comment and an Extension" *The Pakistan Development Review,* Vol. 6, No. 2 (Summer 1966), 248.

A comment on Tinbergen's 'Some Refinements of the Semi-Input-Output Method.'

G310.2100 Sierra, Enrique y Lessa, Carlos. *Glosario y Esquema de Algunas Categorias de la Politica Economica como Proceso.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G310.2300 Sunkel, Osvaldo. *Introduccion al Analisis Economico.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G310.2700 Theil, H. *Optimal Decision Rules for Government and Industry.* Chicago, Illinois, Rand McNally & Company, 1964.

G310.3000 Tinbergen, J. *Balance of Payments and Project Appraisal.* Rotterdam, Netherlands School of Economics, n.d.

This paper contends that there is no need to construct complicated methods to assess the foreign exchange component in investment projects. The best way to choose the sectors in which to invest is to use bunches as the unit to be appraised and bunches, in an ideal development process, are neutral vis-a-vis the balance of payments. The choice based on bunch appraisal will lead to the quickest possible increase in national product and the balance of payments problem can then be solved by measures in the field of public finance. This division of tasks between development authorities and adjustment authorities is much simpler and sufficiently close to an optimum treatment of the balance of payments problem to be preferable to the habit of assessing, for individual projects, the contribution to the balance of payments surplus.

G310.3100 Tinbergen, J. *Simple Devices for Development Planning.* Rotterdam, Netherlands Economic Institute (Division of Balanced International Growth). September 1962.

A simple exposition of the process of development planning. On page 2, an indication is given of a possible relation of the planning of education to this process.

G310.3200 Tinbergen, J. "Some Refinements of the Semi-Input-Output Method," *The Pakistan Development Review,* Vol. 6, No. 2 (Summer 1966), 243.

The semi-input-output method has been proposed as a substitute for the estimation of the indirect effects of investment projects. It attempts to govern national investment in such a way that at no time is there unutilized production capacity and so that the demand for a nation's products is always equal to its output.

G310.4000 Williams, B.R. "Economics in Unwonted Places," *Economic Journal,* Vol. 75 (March 1965), 20-30.

Indicates the consequences of neglecting cost-benefit analysis in British public investment decision-making.

CBA

G311.0400 Eckstein, Otto. "Benefit-Cost Analysis and Regional Development," *Regional Economic Planning.* European Productivity Agency. Organization of European Economic Co-operation, 1961.

G311.0800 Hamburg, Morris. *Statistical Decision Theory and Benefit-Cost Analysis for Preferredness of Choice among Alternative Projects.* Phila., Pa., Wharton School of Finance and Commerce, University of Pennsylvania. A paper for the 12th International Meeting of the Institute of Management Science, Vienna, 1965.

Procedures for the establishment of a model for the evaluation of public projects are discussed. The postponability of investment, uncertainties, and the interdependence of projects' costs and effects are among the variables provided for. This is a mathematical paper and uses statistical decision theory for solutions to the problems discussed.

G311.0900 Hines, Lawrence C. *The Hazards of Benefit-Cost Analysis as a Guide to Public Investment Policy.* Hanover, New Hampshire, Dartmouth College, n.d. (Also in *Public Finance,* Vol. 17, No. 2 (1962), 101-117.

This paper is devoted to an examination of the technical deficiencies in the application of the benefit-cost technique, primarily with respect to its failure to reflect judgments essentially comparable to those of the private market.

G311.1200 Maass, Arthur. "Benefit-Cost Analysis: Its Relevance to Public Expenditure Decisions," *Quarterly Journal of Economics,* Vol. 80 (May 1966), 208-226.

Examines and evaluates cost-benefit analysis, suggesting ways to improve it to make it more applicable to the real issues of public investment.

G311.1800 Prest, A.R. and Turvey, R. "Cost-Benefit Analyses: A Survey," *Economic Journal,* (December 1965), 683-736.

This background paper on rate-of-return analysis surveys the entire field and discusses applications of cost-benefit calculations in water resource planning, transport problems, land usage, health, education and defense. (M. Blaug)

G311.2800 Steiner, Peter O. "The Role of Alternative Cost in Project Design and Selection," *Quarterly Journal of Economics,* Vol. 74, No. 3 (August 1965), 417-430.

In attempting to find the conditions that can be avoided, limited, or made more manageable in the problem of estimating benefits, the author examines the situations where the cost of an alternative project can substitute for or provide limits to benefit measurement. The basic strategy of this study was to set up a model in which two public

projects and two private projects were considered. Then assumptions about the following were varied: what is alternative to what, what combinations of projects are compatible, what institutional rules govern the selection of projects, and what quantities and qualities of services are provided by individual projects.

G311.4000 United Nations Research Institute for Social Development. *Cost-Benefit Analysis of Social Projects.* Report of a meeting of experts held at Rennes, France, September 27-October 2, 1965, Report No. 7, Geneva, April 1966.

The meeting seems to have been a first study of the possibility of developing a cost-benefit analysis for the developmental problems of Europe and the under-developed countries. The papers presented will be abstracted separately in this bibliography.

Urban Projects

G320.0100 Alan M. Voorhees and Associates, Inc. *Multi-Purpose Center for the Baltimore Region, Site Evaluation.* Washington, D.C., Alan M. Vorhees and Associates, Inc. 1964.

This report describes a method for evaluating the desirability of certain proposed sites for large multi-purpose centers in a rapidly growing metropolitan region. Critical sites with potential for large-scale development in the vicinity of Baltimore's Beltway are analyzed in depth; and major site factors, believed to affect selection for development, are measured. The ease or difficulty of development on the available sites is analyzed from these major factors, and a system of site rating or scoring is established. It is believed that this method of evaluation can provide a reliable basis for further exploration of the development process and, in addition, for decisions and action by appropriate private and governmental agents in the establishment of large centers in the Baltimore Region. (Author)

G320.0200 Baltimore City Planning Commission. *Comprehensively Revised Master Plan for Baltimore (A):* Baltimore, Maryland, Baltimore City Planning Commission, 1962.

G320.0250 Baltimore. City Department of Planning. *Planning for Industry in Baltimore City.* Baltimore, Maryland, The Author, 1961.

It was recently estimated that almost one quarter of a million workers will be added to the industrial labor force of the Baltimore region during the next twenty years, calling for as many as 37,000 additional acres of land for industrial use. In recent years, characteristic of older industrial centers, an increasing proportion of the region's industrial growth has been occurring in areas outside the city. Industrial expansion anywhere in the region benefits Baltimore city to some extent by increasing the payroll to be spent in the area and otherwise enhancing its general prosperity. However, the location of industry within its municipal boundaries provides the city with a special financial advantage through the expansion of the tax base. Industrial expansion should not be pursued blindly, because there are other factors to be considered, such as the advantages to the city of uses other than industry for vacant sites and the effects of certain types of industry on surrounding property. There can be little doubt, however, that in Baltimore, where the economic base is so firmly rooted in industry, its continued expansion must be a major objective of public policy. It also seems clear that the city must take affirmative action to obtain for itself an adequate portion of the region's industrial growth. Essential to encouraging and planning for industrial growth and strength is an adequate understanding of the present industrial development in the city, of the changes which have been occurring, and of the factors likely to have a bearing on the possible magnitude and characteristics of future growth. An accurate inventory of the vacant land in the city which can be considered potential for industrial development is of particular importance. The extent of this land the size, location, and other characteristics of the sites which it provides will profoundly affect the city's capacity to expand its industrial plant. Also illuminating for an analysis of the city's industry are comparisons of Baltimore with similar industrial centers.

The Department of Planning has prepared this booklet to fulfill the above needs and to provide a convenient source of information on Baltimore industry for agencies and individuals in the area having use for it. (Author)

G320.0300 Baltimore City Department of Planning. *Residential Planning Districts.* Baltimore, Maryland, Baltimore City Department of Planning, 1963.

G320.0350 Regional Planning Council. *Planning Activities in Baltimore Region.* Baltimore, Maryland, Regional Planning Council, 1964.

G320.0400 Baltimore Regional Planning Council. *Plans and Progress.* Baltimore, Maryland, Baltimore Regional Planning Council, 1966.

G320.0450 Planning Council, Greater Baltimore Committee, Inc. *Preliminary Planning Report.* Baltimore, Maryland, Planning Council, Greater Baltimore Committee, Inc., 1963.

G320.0500 Baltimore Regional Planning Council. *Proposal by the Baltimore Metropolitan Area Study Commission.* Baltimore, Maryland, State Department of Planning, 1962.

G320.0550 Hamburg, Morris and Langford, Thomas W. *Selected Methods of Analysis for Urban Economic Planning and Development in Pennsylvania: Commentary on Regional Economic Accounting Systems, Benefit-Cost Analysis and Statistical Decision Theory.* Harrisburg, Commonwealth of Pennsylvania, Department of Internal Affairs, 1964.

G320.0600 Hawaii. Department of Economic Planning and Development, Planning Division. *Urban Planning Wailuku-Kahului (Maui).* Initiated by the department and conducted by Community Planning, Inc., September 24, 1962.

A land use plan for the development of the town of Wailuku-Kahului.

G320.0650 Hawaii. Department of Transportation, Materials, Research and Testing Laboratory. *Honokahau Development Plan by Community Planning, Inc.* Initiated by the Department and Conducted by the Department with Department of Planning and Research and Department of Land and Natural Resources, n.d.

G320.0800 Luke, Herbert K.C. and Kasamoto, Hiroshi. *The Waiakea Plan--A New Comprehensive*

Plan for Waiakea and the Hilo Waterfront, City of Hilo, Hawaii County, State of Hawaii. Hawaii, Department of Land and Natural Resources, Planning Office, March 25, 1965.

G320.2000 Pearce, D.W. and Herrington, P.R. "Economic Aspects of the Morecambe Bay Barrage," *District Bank Review,* (June 1965) 39-55.

Regional Projects

G330.0100 Artle, Roland. *Planning and Growth–A Simple Model of an Island Economy: Honolulu, Hawaii.* Hawaii, Department of Planning and Economic Development, Oahu Transportation Study, 1964.

G330.0200 Bray, R. *Talk on Planning Programs.* Hawaii, Department of Planning and Economic Development, Planning, August 1, 1963.

G330.0300 Celestin, G. *La Preparation du Developpement Regional en pays peu Developpe.* Presentes par l'IRFED a la Conference Scientifique des Nations-Unies pour l'Application de la Technique et de la Science dans l'Interet des Regions peu Developpes, Geneve, Fevrier 1963.

G330.0800 Gonzalez, Norberto. *Técnicas de Planificacion (Seminarios).* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G330.0900 Hawaii. Management Services Division, Department of Budget and Review. *Management Guide on How to Design and Administer a Training Program,* November 1962.

G330.0950 Hawaii. Management Services Division, Department of the Budget and Review, in cooperation with the Department of Personnel Services. *A Plan for a Leadership Training and Development Program for Officers and Employees of the State of Hawaii.* February 1962.

G300.1000 Hawaii. Management Services Division, Department of Budget and Review. *A Report on the Feasibility of Consolidating Certain State Veterinarian Programs.* March, 1962.

G330.1050 Hawaii. Department of Economic Planning and Development, Miscellaneous Reports and Publications. *State and County Planning in Hawaii during 1961.* March 1, 1962.

G330.1100 Hawaii. Department of Planning and Economic Development, Miscellaneous Reports and Publications. *State Planning in Hawaii, 1957-1961, 1957-1963.* Revised December 1961 and February 1963.

G330.1200 Isard, Walter and Cumberland, John H. (eds.). *Regional Economic Planning. Techniques of Analysis for Less Developed Areas.* Bellagio Conference, July 1961. Paris, OECD, 1961.

Introduction – The regional, national and institutional setting; Basic problems of regions in the process of economic development; Techniques of analysis; Synopsis and summary.

G330.1300 Lebret, L.J. *Le Probleme des Valeurs et des Relations dans la Planificacion et la Programmation du Developpement.* Presentes par l'IRFED a la Conference Scientifique des Nations-Unies pour l'Application de la Technique et de la Science dans l'Interet des Regions peu Developpes, Geneve, Fevrier 1963.

G330.1400 Mayne, Alvin. *Designing and Administering a Regional Economic Development Plan with Specific Reference to Puerto Rico.* Paris, OECD, November 1961.

G330.1500 McClure, George E. and Bayles, Philip L. *A Framework for Regional Forecasting, Program Formulation and Sensibility Analysis in Metropolitan Honolulu.* Hawaii, Department of Planning and Economic Development, Oahu Transportation Study, September 1964.

Presentation at the 10th Annual and 1st International Meeting, Western Section ORSA.

G330.1600 Nove, Alec and Newth, J.A. *The Soviet Middle East – A Communist Model for Development.* London, George Allen & Unwin, 1967.

A study of the development of the Soviet Middle East within the wider context of economic progress in Russia.

G330.1700 Organization for Economic Co-operation and Development. *Development Plans and Programmes.* Paris, OECD, September 1964.

Papers presented at the Third Annual Meeting of Directors of Economic Development Training Institutes. Present several case studies related to the elaboration and implementation of development plans.

G330.1800 Peacock, Alan T. (ed.) *Public Finance as an Instrument for Economic Development.* University of York, 1-23 July 1964. Paris, Organization for Economic Co-operation and Development, December 1965.

The booklet opens with an introductory chapter on "Fiscal Policy for Economic Development in Theory and Practice" by Professor Alan T. Peacock of the University of York, who acted as Director of Studies. The four other chapters examine the role of the fiscal system in the economic development policies of Greece, Portugal, Spain and Turkey. It is thus possible, in this booklet, to compare the fiscal measures of countries with very similar economic situations.

G330.2200 Tinbergen, J. "De Economicshe Balans van het Deltaplan," The Balance Sheet of the Delta Plan. Summary in English. Appendix VI to *Report of the Delta Committee.* Netherlands Governments, 1961.

G330.3000 U.S. Department of Agriculture. *Rural Industrialization: A Summary of Five Studies.* Washington, D.C., 1961.

Underdeveloped Regions

G331.2000 Pellouet, M. and Anouti, J. *Choix des Objectifs et des Moyens dans l'Amenagement en Equipements Sociaux d'une Region Sous-Developpee.* Presentes par l'IFRED a la Conference Scientifique des Nations-Unies pour l'Application de la Technique et de la Science dans l'Interet des Regions peu Developpes, Geneve, Fevrier 1963.

G331.2200 Ramage, R. "The Assessment of Staff Requirements in a Developing Country," *Public Administration,* Vol. 41 (Winter 1963), 325-33.

Written by an administrator, the article comments on the necessity and process of planning the provision of administrative personnel. The educational aspect of fulfilling targets arrived at is considered.

G331.3000 United Nations. Economic Commission for Africa. "Some Problems of Social Development Planning in Relation to Economic Development," *Economic Bulletin for Africa,* Vol. 11, No. 2 (June 1962), 82-91.

The article is an endeavour to show how the planning of social services, in which education is included, can be brought in close relation with the planning of economic development.

Multinational

G332.1000 Lyons, R., "The Organization for Economic Cooperation and Development Mediterranean Regional Project," *The Residual Factor and Economic Growth,* ed. J. Vaizey. Paris, OECD, 1964.

A brief description of the project and an indication of its present state. (M. Blaug)

G332.2000 Organization for Economic Cooperation and Development. *The Mediterranean Regional Project. An Experiment in Planning by Six Countries.* Paris, OECD, 1965.

A description of M.R.P. and a summary of the main findings together with some statistical tables. (M. Blaug)

G332.2050 Organization for Economic Cooperation and Development. *The Mediterranean Regional Project. An Experiment in Planning by Six Countries.* Paris, OECD, December 1965.

G332.2200 Organization for Economic Cooperation and Development. *The Union for the Coordination of Production and Transmission of Electricity.* Paris, OECD, June 1963.

"Ten Years of Activity".

Latin America

G333.0100 Ahumada, Jorge. *Teoría y Programacion del Desarrollo Economico.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.0150 Ayza, Juan. *Números Índices.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.0170 Ayza, Juan. *Progresiones y Tasas de Crecimiento.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.0200 Balboa, Manuel. *Contabilidad Social.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.0300 Cardoso, Fernando. *Las Elites Empresariales en America Latina.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.0320 Cardoso, Fernando y Reyna, Jose Luis. *Industrializacion, Estructura Ocupacional y Estratificacion Social en America Latina.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.0350 Cibotti, Ricardo y Weffort, Francisco. *Caracteristicas Sociologicas del Estado y la Planificacion del Sector Publico.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.0400 Danieli, Shimon. *Administracion y Organizacion para la Planificacion.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.0600 Economic Commission for Latin America. "The Creation of a United Nations Economic Projections and Programming Centre and the Techniques of Projections," *Economic Bulletin for Latin America,* Vol. VII, No. 2, n.d.

G333.0650 Economic Commission for Latin America. *Economic Development, Planning and International Cooperation.* Santiago, Chile, ECLA, December 1961.

G333.0700 Economic Commission for Latin America. *The Selective Expansion of Agricultural Production in Latin America.* Santiago, Chile, ECLA, February 1957.

G333.0750 Economic Commission for Latin America. *Towards a Dynamic Development Policy for Latin America.* Santiago, Chile, ECLA, December 1963.

G333.0800 Economic Commission for Latin America. *Workshop on Budgetary Classification and Management in South America,* Santiago, Chile, ECLA, 1959.

G333.0900 Ibarra, Jose. *Resumen Sobre Ordenacion y Presentacion de Proyectos.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1000 Division de Investigacion y Programacion General. *Algunos Aspectos de la Incorporacion de la Integracion Economica a los Planes de Desarrollo.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1050 Division de Investigacion y Programacion General. *Algunos Aspectos del Metodo Utilizable para Incorporar la Integracion Economica a los Planes de Desarrollo de America Latina.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1100 Division de Investigacion del Desarrollo Economico. *Antecedentes Cuantitativos Referentes al Desarrollo de America Latina (dos tomos).* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1150 Division de Investigacion y Programacion General. *Centroamerica: Analisis del Sector Externo y de su Relacion con el Desarrollo Economico.* Santiago, Chile, Instituto Latinoamericano de Planificacion y Social, n.d.

G333.1200 Division de Investigacion del Desarrollo Economico. *El Concepto de Desarrollo.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1250 Division de Investigacion del Desarrollo Economico. *Desarrollo Economico.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1300 Division de Investigacion y Programacion General. *La Intergracion Economica en America Latina.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1350 Division de Investigacion y Programacion General. *La Integracion Economica y los Planes Nacionales de Desarrollo.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1400 Division de Investigacion y Programacion General. *Integracion, Sector Externo y Desarrollo Economico de America Latina.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1450 Division de Investigacion y Programacion General. *Planes de Financiamiento.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1500 Division de Investigacion y Programacion General. *Principales Elementos a ser Considerados en el Diagnostico Macroeconomico y Relaciones entre los Mismos.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1530 Division de Investigacion y Programacion General. *La Relacion de las Politicas y Planes de Desarrollo con la Integracion Economica.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1600 Division de Investigacion y Programacion General. *The Role of the External Sector in the Economic Development of Central America.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1650 Division de Investigacion del Desarrollo Economico. *Seminarios de la Catedra de Desarrollo Economico.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.1700 Division de Investigacion y Programacion General. *Some Aspects of the Method Applicable for Taking Economic Integration into Account in Latin American Development Plans.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.2000 Martner, Gonzalo. *Los Sistemas Presupuestarios en America Latina Organizacion Administrativa para el Planeamiento del Desarrollo Economico.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.2100 Monti, Angle. *La Programacion del Financiamiento a Corto Plazo.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.2200 Naon, Eduardo y De Barbieri, Juan. *Notas Sobre los Fundamentos de La Contabilidad Social.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.3000 Sunkel, Osvaldo. *El Fracaso de las Politicas de Estabilizacion.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.3040 Sunkel, Osvaldo. *Politica Nacional de Desarrollo y Dependencia Externa.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.3080 Sunkel, Osvaldo. *The Structural Background of Development Problems in Latin America.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.3120 Szabo, Zoltan. *Algunos Aspectos de la Planificacion Industrial en Centroamerica.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G333.6000 Vuskovic, Pedr. *Técnicas de Planificacion.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

For Economic Growth

G340.0300 Colm, Gerhard (ed.). *Organization, Planning and Programming for Economic Development.* Washington, D.C., U.S. Government Printing Office, 1963.

Papers prepared in the United States for the U.N. 'Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas' at Geneva, dealing with economic planning for development.

G340.0400 Committee for Economic Development. Statements on National Policy. *How Low Income Countries Can Advance Their Own Growth.* September 1966. N.Y., CED, September 1966.

English and Spanish editions; includes CICYP statement, Economic Development of Latin America.

G340.0450 Committee for Economic Development. *Managing a Full Employment Economy – A CED Symposium on Problems of Maintaining Prosperity Without Inflation.* N.Y., CED, June 1966.

G340.0500 Dobb, Maurice. *An Essay on Economic Growth and Planning.* London, Routledge and Kegan, Paul, 1960.

A discussion of some theoretical issues in the planning of economic growth, which conceivably could have application to the planning of educational investment.

G340.0800 Higgins, Benjamin. *Economic Development.* New York, Norton and Co. 1959.

Basic textbook on economic development. Chapter 27 deals with the planning of development.

G340.0850 Hirschman, Albert O. *The Strategy of Economic Development.* New Haven, Yale University Press, 1958.

An influential and controversial analysis of the economic development process.

G340.0900 Institute of Social Studies. Course, *Industrial Development Programming.* The Institute of Social Studies, The Hague, Netherlands, n.d.

Includes feasibility and cost-benefit analysis.

G340.1000 Division of Investigacion del Dessarrollo Economico. *El Modelo de Crecimiento de David Ricardo.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G340.1100 Division de Investigacion del Desarrollo Economico. *El Modelo de Crecimiento de Meade.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G340.1150 Division de Investigacion del Desarrollo Economico. *El Modelo Marxista de Crecimiento Economico.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G340.1200 Division de Investigacion del Desarrollo Economico. *Dos Modelos Post-Keynesianos de Crecimiento Economico: Domar y Harrod.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G340.1400 Kaser, M.C. in H.D. Stein (ed.). *Planning for the Needs of Children in Developing Countries.* New York, United Nations International Childrens Emergency Fund, 1965.

Statement to Round Table Conference, emphasizing importance of projecting results of given social methods and of outlays for given social ends; such projections are essential for rationally choosing social priorities.

G340.1500 Klaassen, L.H. *Area Economic and Social Redevelopment.* Guidelines for Programmes. Paris, Organization for Economic Cooperation and Development, June 1965.

This study provides central government officials, regional and local developers and physical planners and citizens in economically distressed areas with guides for organizing agencies for economic development, and their research programmes.

G340.1600 Lange, Oscar, *et al.* "Problemes de la Planification," *Cahiers Internationaux,* No. 109 (decembre 1959 - janvier 1960), 43-60.

The text of a discussion of the nature of, and the need for, planning in economic development.

G340.1700 Lebret, L.J. *Dynamique Concrete du Developpement.* Paris, Economie et Humanisme, Les Editions Ouvrieres, 1961.

A significant French text on economic development.

G340.1800 Lefeber, Louis., "Economic Development and Regional Growth," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 108-122.

Regional economic growth has been analyzed in the context of a labor surplus economy and with an emphasis on the criteria for efficiency. Efficiency is not a goal in itself; it is a requisite companion of the highest attainable rate at which a national economy can grow and unemployment can be absorbed. Competitive pricing and investment policies will lead, if conditions are favorable, to efficient patterns of national and regional growth.

Regional economic policies can be subject to heavy political pressures and the conditions for competitive pricing may not be present. This absence can be remedied by implementing the pricing mechanism with suitable subsidy and tax programs. This should typically be the case with transportation development and in other instances where increasing returns, risk, and external economies may be important.

As to politically motivated distortions in investment and pricing policies, the economist can do no more than warn about the excess costs of inefficient methods of subsidization. Disregard for efficient pricing and investment policies slows down the rate of growth of the economy and the

attainment of full employment; hence, the goals of a program for economic development may be jeopardized. (Author)

G340.1900 Lewis, W.A. *Development Planning. The Essentials of Economic Policy.* London, George Allen & Unwin, 1966.

A guide to the techniques of development planning. Some of the author's well-known papers on educational planning are skillfully woven into the text. (See particularly, pp. 104-110, 222-234.) (M. Blaug)

G340.1950 Lewis, W. Arthur. "Economic Problems of Development," *Development Research Digest,* Vol. 1, No. 3 (January 1963), 1-14.

In this paper the author highlights some of the tensions associated with the development process, in turn highlighting some of the difficulties which education can help to overcome.

G340.2000 Maddison, Angus., "Growth Problems in Underdeveloped Countries," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, p. 17-25.

The author briefly reviews the growth problems of the developing countries, and also their growth opportunities, including educational progress.

G340.2100 Mason, Edward S. *Economic Planning in Underdeveloped Areas.* New York, Fordham University Press, 1958.

In these lectures the author considers the case for state management of development, i.e. national planning, in developing countries, which he considers is favorable. The final lecture considers some southeast Asian experiences in planning.

G340.2200 Meier, R.L. *Development Planning.* London, McGraw-Hill, 1965.

This textbook on the practical problems of development planning in poor countries breaks new grounds in devoting about a quarter of the total coverage to educational planning. (M. Blaug)

G340.2300 Myrdal, Gunnar. *Economic Theory and Underdeveloped Regions.* London, Duckworth and Co., 1957.

Part I characterizes underdevelopment as evidence of international economic inequality, and outlines the process producing this. The need for planning to remedy this trend is stressed (Chapter 7) as is the need for new departures in the theoretical study of development.

G340.2400 Nicholls, William H. "Accommodating Economic Change in Underdeveloped Countries," *American Economic Review,* Vol. XLIX, NO. 2 (May 1959), 156-168.

The author discusses some of the changes in the social, political, and institutional environments which assist economic development, instancing Japan as an example of these processes, including its emphasis on educational growth.

G340.2500 Nurkse, Ragnar. *Problems of Capital Formation in Underdeveloped Countries.* Oxford, Basil Blackwell, 1953.

A key text in the theory of economic development. In his introduction the author states that he refers to human as well as physical capital, though the discussion is conducted in relation to the latter, education receiving only passing specific references.

G340.2600 Tinbergen, J. *The Design of Development.* Baltimore, The Johns Hopkins Press, 1958.

A valuable introductory discussion of techniques for planning economic development.

G340.2700 Turin, Gabriel. "Planificacion et Developpement," *Developpement et Civilisations,* No. 8 (octobre - decembre 1961), 56-65.

A brief introduction to the planning process and its role in development.

G340.3700 U.S. Congress. Joint Economic Committee. *Federal Expenditure Policy for Economic Growth and Stability.* 85th Congress, 1st Session, Washington, D.C., November 18-27, 1957.

National Projects

G350.0100 Ayza, Juan. *Nociones Sobre Planificacion en los Paises Socialistas.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

G350.0150 Adb al-Rahman, Ibrahim Hilmi. *al-Tawjihat al-ammah lil-takhtit al-qawmi.* Memorandum No. 173. Cairo, National Planning Institute, 1962.

General guide lines for national planning.

G350.0300 Charriere, Jacques. "La Guinee. Une Experience de Planificacion," *Cahiers Internationaux,* No. 117 (mars-avril 1961), 65-82.

A survey of planning methods, organization and programmes, including that for education, in the Republic of Guinea.

G350.0400 Curle, Adam. "Tradition, Development and Planning," *The Sociological Review,* Vol. 8, No. 2. New series, (December 1960) 223-38.

On the basis of experiences in Pakistan, the author discusses the need for planning to be an exercise in which the community actively participates, in order to avoid the dichotomy of the planners and the planned for, and possible conflicts between traditional and developmental authorities. This involves a close linking of global planning to local planning.

G350.0500 Debeauvais, M., *et al. Formation Technique et Developpement Economique en Tunisie.* Tunis, UNESCO Mission, April 1961.

Critical review of the Tunisian educational system and the Ten-Year Plan for its reform initiated in 1958 in the light of economic development and associated technical training needs.

G350.0800 Economic Commission for Latin America, "Fifteen Years of Economic Policy in Brazil," *Economic Bulletin for Latin America,* Vol. IX, No. 2, n.d.

G350.1000 Helbaoui, Youssef. "Developpement et Planification en Syrie," *Developpement et Civilisations,* No. 13 (mars 1963), 46-63.

A description of the planning process and organization in Syria, centered around the Ten-Year economic plan 1960-1961 to 1970-1971.

G350.1100 International Bank for Reconstruction and Development. *The Economic Development of Uganda.* Report by the IBRD, Baltimore, The Johns Hopkins Press, 1962, p. 343-374.

A review of the present situation and a list of policy recommendations. (M. Blaug)

G350.1400 Le Guay, Francois. "Planning in France," *Economic Bulletin for Latin America,* Vol. VIII, No. 1, n.d.

G350.1500 MacFarlane, David L. and Oworen, Martin A. *Investment in Oil Palm Plantations in Nigeria.* Nsukka, Eastern Nigeria, Economic Development Institute, University of Nigeria. August 1965.

G350.1600 Nair, Kusum. *Blossoms in the Dust.* London, Duckworth and Co., 1961.

An investigation of the impact of planned development on India's rural communities. In Chapters 19 and 20 the author shows how unimaginative educational expansion can disrupt rather than assist the development of the rural sector.

G350.1800 Peacock, Alan T. and Dosser, Douglas. "Stabilization and Economic Planning in African Countries," *Public Finance,* Vol. XVIII, No. 3 (1962) 235-257.

G350.1820 Peacock, Alan T. and Dosser, Douglas. "Stabilization and Economic Planning in African Countries," *Stabilization and Economic Journal,* Vol. XVIII, No. 3, 1962.

G350.2000 "Economic Planning in France," *Planning,* Vol. XXVII, No. 454 (14 August 1961), 207-237.

The record of a conference held in England to explain the French method of 'indicative planning,' which has become the best-known alternative to the Communist method of planning. A short section discusses the planning of education.

G350.2500 Rasul, G. *Input-Output Relationships in Pakistan, 1954.* New York, Humanities Press, Inc., 1964.

G350.3000 Sandee, J. *A Demonstration Planning Model for India.* London, Asia Publishing House, 1960.

G350.3500 Sunkel, Osvaldo. *Cambio Social y Frustracion en Chile.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

FOREIGN AID

G400.0100 Arthur D. Little, Inc. *Third Nigeria Industrial Development Management Training Program.* New York, Arthur D. Little, Inc., n.d.

ADL is conducting a third experimental training program as an outgrowth of our assignment, which began over four years ago and still continues, as industrial development advisers to the Federal and Regional Governments of Nigeria. This experimental training effort is attempting to meet the need for government administrators skilled in the management of industrial development since they will ultimately assume responsibility for managing Nigeria's program.

The ten-month course, conducted primarily at ADL-Cambridge, has already led to the conclusion that there are substantial benefits to be derived from tailoring a program of this type to the specific objectives, job responsibilities and backgrounds of the participants by drawing training inputs from a broad range of professional and academic disciplines. A second conclusion is that the simulation case technique being used represents an important new resource for training in industrial development since it is a means of bringing to bear in the classroom the wealth of existing practical experience in the field. Additional conclusions are that the case method of teaching is important in a program of this type and that the professional environment of the program has a significant influence on the performance and personal involvement of the participants. A significant aspect of the experiment is that the training concepts and approaches of this program, while developed to meet the needs of Nigeria at its present stage in industrial development, should have broad application in the developing world. The third training program includes participants from Ghana in addition to the Nigerian group.

G400.0300 Chenery, Hollis B. and Strout, A.M. "Foreign Assistance and Economic Development," *American Economic Review,* Vol. 56 (September 1966), 679-733.

A model is presented to demonstrate the conditions under which external assistance can result in significant acceleration of economic development. The implications of this analysis for effectiveness and allocation of foreign assistance are presented.

G400.0400 Cockcroft, Sir John. *Technology for Developing Countries.* Overseas Development Institute. London, Research Publications, 1967.

An examination of the British effort to promote technology suitable for developing countries. The text of a lecture given under the auspices of the ODI in January 1966.

G400.0800 Hayter, Teresa. *Effective Aid.* London, Overseas Development Institute, 1967.

Reports and papers of a conference on improving the effectiveness of aid for development, with a small number of participants, mostly directly concerned in administering aid from the United States, France, Britain, Germany and some international institutions.

G400.0850 Hayter, Teresa. *French Aid.* London, Overseas Development Institute, 1967.

A comprehensive analytical survey of the aid programme of the world's second largest donor. Fully documented with statistical tables.

G400.0900 Hoffherr, Rene. "Le Probleme de l'Encadrement Dans les Jeunes Etats de Langue Francaise en Afrique Centrale et a Madagascar," *Tiers-Monde* Tome III, No. 2 (octobre-decembre 1962), 529-63.

The article discusses the sudden need for skilled manpower among the newly independent states of Africa, methods of estimating these needs, and the contribution to their fulfillment which can be made by services such as those for 'stagiaires' in France.

G400.1200 Maddison, A. *Foreign Skills and Technical Assistance in Economic Development.* Development Centre Studies. Paris, Organization for Economic Cooperation and Development, 1965.

This pamphlet gathers some data on the flow of technical assistance to the developing countries, on the basis of which the author makes a number of concrete recommendations to both the recipients and the donors of aid to maximize the effectiveness of technical assistance. The work includes a useful bibliography. (M. Blaug)

G400.1400 Moyes, Adrian. *Volunteers in Development.* London, Overseas Development Institute, 1967.

A critical evaluation of the use of volunteers as a form of technical assistance, with radical proposals for the reorganization of the British volunteer system.

G400.1600 Pincus, John A. *Economic Aid and International Cost Sharing.* R-431-ISA. The RAND Corp., Santa Monica, Calif., 1965.

Analyzes the issues related to sharing the costs of internationally financed activities and suggests ways to deal with some of these problems. Part of the material in Chapter V appeared in *Review of Economics and Statistics,* Vol. 45 (November 1963), 360-366.

G400.2000 Schultz, T.W. "U.S. Endeavors to Assist Low-Income Countries Improve Economic Capabilities of Their People," *Journal of Farm Economics,* (December 1961), 1068-1077.

After some introductory remarks on human capital, the author discusses the implications for American educational assistance of underinvestment in human capital in low-income countries. (M. Blaug)

G400.2100 Soper, Tom. *Aid Management Overseas.* London, Overseas Development Institute, 1967.

A study giving particular attention to British Aid administration overseas.

G400.6000 Ward, Barbara. *The Decade of Development--A Study in Frustration?* London, Overseas Development Institute, 1967.

MILITARY

Management

M000.0100 Bowman, Richard C. "Analysis in War Planning," *Air University Review,* Vol. 17 (March-April 1966), 40-48.

M000.0117 Carey, William D. *Remarks Before the Naval Postgraduate School Defense Management Systems Course.* Monterey, California, November 19, 1965. Washington, D.C., Bureau of the Budget, 1965.

M000.0119 Novick, D. *New Tools for Planners and Programmers.* P-2222. The RAND Corporation, Santa Monica, Calif., February 1961. Also published in *The Executive,* Vol. 5, No. 4 (September 1961).

The information needs of military planners and decision-makers are described as (1) a comprehensive and correlated flow of information, with an evaluation of both current and projected programs; (2) data on new technological developments and breakthroughs supported by an evaluation of their impact in terms of equipment, military concepts, and international commitments; (3) coordination of planning on an across-the-board basis; and (4) a framework for considering the alternative uses of resources to achieve national goals. A distinction is drawn between information needed to make decisions and that needed to carry out decisions or manage activities. For the decision-maker, a format is required, oriented toward end-objectives and suited to the examination of alternatives. Administrators and managers require a presentation in terms of administrative categories suited to the execution of tasks.

M000.0120 Clark, John J. "The Management of National Defense by Systems Analysis: An Evaluation," *Royal United Service Institute Journal,* Vol. 109, (November 1964), 298-308.

M000.0140 Enthoven, Alain and Rowen, Henry, "Defense Planning and Organization," *Public Finances: Needs, Sources and Utilization,* Universities-National Bureau for Economic Research. Princeton, N.J., Princeton University Press, 1961, p. 365-420.

"This is an exploratory essay on the organization of the Department of Defense. We use the word 'organization' in a broad sense, to include not merely the assignment of roles and missions, but rather the whole set of mechanisms through which the business of defense is conducted. In this essay we attempt to do three things. First, we explain what we think are some of the shortcomings of the present organization. Next we consider the general question of intelligibility of defense allocation problems. Finally, we develop some of the implications of the principles we have discussed, and we put forward a few practical suggestions." (Author)

M000.0160 Fisher, G.H. *Analytical Support for Defense Planning.* P-2650. The RAND Corporation, Santa Monica, California, October 1962. (DDC No. AD 607-649).

In this description of the development of systems analysis in the defense planning process, distinction is drawn between operations research and systems analysis. Operations research is conducted for current operational problems,

while systems analysis is concerned with the future and is used as an aid for development and procurement decision-making. With the emphasis placed on future time periods of 5, 10, and 15 years, the problem of uncertainty takes on major proportions, making analysis and measures of variance important. The five major elements in systems analysis are described as (1) statement of objectives, (2) specification of alternatives, (3) cost estimating, (4) a model describing relationships and (5) criteria for choice among alternatives. The use of gaming as an alternative to systems analysis is also described. Techniques derived from systems analysis are (1) systems cost analysis, (2) force structure cost analysis and program budgeting, (3) Monte Carlo methods, (4) dynamic programming and (5) measures of systems effectiveness.

M000.0171 Grosse, R.N. *An Introduction to Cost-Effectiveness Analysis.* RAC-P-5. Research Analysis Corporation, McLean, Virginia, July 1965.

Discusses the use of economic analysis as a conceptual framework for assisting military planners and decision-makers. The analysis involves the systematic examination of costs, effectiveness, and risks of alternative policies, strategies and courses of action. The economic basis for cost analysis is presented. The use of isoquants is discussed together with equal cost budget lines, production functions and total cost curves. The concept of complementarity is considered. Examples are included of effectiveness models and cost models.

M000.0180 Hitch, Charles J. *Decision-making for Defense.* Berkeley, University of California Press, 1965.

Traces the historical evolution of defense management, describes the purpose and function of the programming system installed in 1961, and explains the application of systems analysis techniques to the problems of defense.

M000.0183 Hitch, C.J. *Uncertainties in Operations Research.* P-1959. The RAND Corporation, Santa Monica, California, April 1960.

A discussion of the uncertainties faced by operations researchers in determining a preferred strategy. The job of the operations researcher is to find, or invent, within the constraints, some better pattern of adjusting to an uncertain world, or by taking costs and payoffs into account, to buy information to reduce the uncertainty. The author is skeptical of general-purpose solutions to the problems of making good decisions for uncertain contingencies. He indicates that a shift is necessary from searching for the best way to choose between two contingently satisfactory answers to searching for a better answer. The uncertainties involved in military problems have their counterparts and analogues in business and in everyday life.

M000.0187 Hoch, Saul. *Some Comments on the Cost and Economic Information System.* 2nd Congress Information Systems Science, 403-409.

Cost effectiveness and systems analysis as applied to program management in the Department of Defense has achieved a considerable degree of prominence in recent years. In line with the overall program management goals of DOD, the Cost and Economic Information System (CEIS) was initiated to provide information useful in: (1) Cost estimating and analysis; (2) Program management; (3) Projecting the effect of military programs on the economy. The objective of CEIS and its relation to other information systems such as PERT/Cost are described in this paper.

M000.0200 Myers, Stephen G. and Hugo C. George. *An Analysis of the Chronic Offender Problem Within the Armed Forces.* Master's thesis, Naval Postgraduate School, Monterey, California, 1965. (DDC No. AD-475-321).

Delinquency – habitual delinquency – is presently of major concern to virtually every American military activity. In 1964, almost 25,000 servicemen were discharged from the armed forces for reasons of unfitness. Many thousands more were involved in major offenses, court-martialled, and confined in military correctional institutions. The cost of these disciplinary proceedings is staggering – both in terms of dollars and loss of military operational effectiveness – and is increasing every year. With our present high emphasis on qualitative analysis, maximum utilization of resources and cost effectiveness within the Department of Defense, it would seem obvious that a whole-hearted effort should be made to reduce the high cost of military discipline. This paper attempts to point out the factors and variables involved in the personalities who become chronic offenders, examines what is now being done by the military to combat the problem, and proposes policy modifications designed to maximize our effectiveness in dealing with deviant individuals.

M000.0207 Nelson, R.L. "Managerial Look at the Science of Systems Analysis," *Naval Engineers Journal,* Vol. 77 (August 1965), 607-611.

M000.0220 Novick, D. *The Role of the Military Comptroller in Defense Management.* P-2336. The RAND Corporation, Santa Monica, California, June 1961. Also published in *The Armed Forces Comptroller.* Vol. 6, No. 4 (December 1961) 29-32.

Describes the functions of management in the defense establishment. A comparison is made between military management and that of a large private business organization. Top management is responsible for allocating available resources to meet objectives. This carries with it a responsibility for implementing decisions and evaluating operating results. It is the Comptroller's responsibility to ensure (1) the availability of necessary data to make allocation decisions, and (2) to design and operate a reporting system within which the decisions can be evaluated and implemented. The DOD program budgeting concept is described as a first step toward providing an effective system for top management decision-making.

M000.0240 Novick, D., and G.H. Fisher. *The Role of Management Tools in Making Military Decisions.* P-694. The RAND Corporation, Santa Monica, California, June 1955. (DDC No. AD 422835).

Discusses decision-making processes in the military establishment, particularly as they apply to planning decisions and the problems of choice among future courses of action. The problem of the selection of proper management tools from among those available is described. A comparison is made between military and industrial applications of management tools. Because their purposes are different, tools for industry are only partly applicable to the military. Budgeting and accounting procedures are examined in the light of the needs of decision-making, particularly for military decisions concerned with the development, procurement and operation of weapon and support systems.

M000.0260 Pardee, F.S. *The Financial Portion of a Management Information System.* RM-2836-PR. The RAND Corporation, Santa Monica, California, December 1961. (DDC No. AD 413607).

This memorandum presents the objectives and features of an information system for military planners and decision-makers. The system should permit an evaluation of the cost implications of alternative courses of action. It should contain the following features: (1) R & D, investment, and operating cost categories, (2) data on the sensitivity of cost to system design and operational concept, (3) data to make force composition analyses, (4) data aggregations consistent with varying management levels, (5) data to permit the derivation of estimating.

M000.0280 Pardee, F.S. *Guidelines in Accumulating Financial Data on Future Weapons.* RM-2583-ARPA. The RAND Corporation, Santa Monica, California, May 1960. (DDC No. AD 418652).

Provides guidance for the collection of the financial data necessary to evaluate weapon systems. Such data are needed for the analytical process of measuring operational capability and total financial requirements. A background discussion deals with cost concepts, uncertainty, and the form of the data. Weapon system descriptive data and their importance are discussed. Two basic formats present the major cost elements to be considered in predicting the economic impact of a future weapon system. A checklist of cost elements is provided.

M000.0300 Quade, E.S. (ed.). *Analysis for Military Decisions.* R-387. The RAND Corporation, Santa Monica, California, November 1964. (DDC No. AD 453887). Also published by Rand McNally, Chicago, 1964.

Consists of a presentation of the lectures from a RAND Corporation course of instruction entitled "An Appreciation of Analysis for Military Decisions." This material was prepared primarily for decision-makers and not for analysts. Its purpose is to point out the weaknesses and possible abuses, as well as the effectiveness, of an analytical approach to long-range military planning. Included are descriptions of (1) the origins and development of systems analysis, (2) the elements and methods common to all analyses and (3) special problems. Illustrative examples are also included.

M000.0305 Quade, E.S. *Some Comments on Cost-Effectiveness.* P-3091. A report prepared for presentation as part of a panel on "Cost-Effectiveness" at the U.S. Army Operations Research Symposium (4th). Redstone Arsenal, Alabama, March 31, 1965. The RAND Corporation, Santa Monica, Calif., March 1965. (DDC No. AD-615 394).

Distinction between systems analysis and cost effectiveness, limitations of analyses in defense planning, pitfalls of analyses in defense planning, the 'cherished belief' leading to an 'attention bias,' the most frequent cause of failure to look at a full range of alternatives transferring a portion of an administrator's decision-making function to a model, current status of systems analysis, advantages of systems analysis.

M000.0310 "Systems Effectiveness: ONM's Approach," *Data,* Vol. 10, No. 5 (May 1965), 35-40.

This article contains an interview with Commander Keith N. Sargent, USN, concerning "Systems Effectiveness" and related topics.

M000.0320 U.S. Air Force, Headquarters, Air Force Systems Command. *WSEIAC. Management Systems, Elements of Effectiveness Assurance Management.* AFSCR-TR-65. Final Report of Task Group V, Vol. II. Andrews Air Force Base, Maryland, January 1965.

". . . presents summaries of many of the studies carried on by the task group during the six months of WSEIAC formal meetings and investigations. From these studies the concept and philosophy of a System Effectiveness Assurance Management System (SEAMS), the major policy issues, and recommendations presented in Volume I were developed. Air Force management of system effectiveness activities is assessed through surveys of some of the principal offices and commands. Industry capability for response to these new requirements is measured. A review of activities and discipline requirements essential to effectiveness assurance management in the context of the AF 375 series documents is provided. Finally, a series of studies and discussions of pertinent elements of system effectiveness is furnished, including a data central proposal, the effect of incentives, and appendixes on specification management, parts research and program management elements of the concept and definition phases of system development."

M000.0340 U.S. Department of the Army, Chief of Engineers. *Annual Report, 1951,* Vol. 2, Part I. Washington, D.C., Department of the Army, 1951.

M000.0360 U.S. Office of the Chief of Naval Operations. *Navy Programming Manual.* OPNAV 90P-1. Washington, 1965.

Standard reference for the operation of the Department of Defense programming system in the Navy.

M000.0520 Vazsonyl, A. "Automated Information Systems in Planning, Control and Command," *Management Science,* Vol. 11, No. 4 (February 1965), B2-41.

On-line-real-time information systems, control of space travel, control of airline reservations, military command and control, planning and control of research and development are related to man-machine problems; use of computer to aid man in engineering design, automated programming (PERT) and other functions in which man or machine alone represents optimum system.

M000.0740 Wilson, R.S. *Systems Engineering Management of Design Engineering.* American Society of Mechanical Engineers – Paper 64 – MD – 46 for meeting May 11-14, 1964.

Systems engineering is general management activity requiring administrative as well as engineering skills; while its function is basically that of design control. It also comprises responsibilities of liaison, scheduling, laboratory and field test planning, component design, evaluation, record of design, and general communications: in short, systems engineering is practical control and realization of design; functioning of systems engineering in development of atomic weapons within portion of complex Atomic Energy Commission and Department of Defense structure is explained.

M000.0820 Witze, C. "Cost Effectiveness–Tool or Club?, *Air Force Magazine,* October 1963.

Budgeting

M010.0100 Clark, John J. "The Economics of Systems Analysis," *Military Review,* Vol. 44, No. 4 (April 1964), 25-31.

Describes the more recent efforts of economists in regard to the central issues of defense policy and programming, which are defined as the allocation of funds, the deployment of forces, logistical problems, research and development decisions, and the size and mix of weapons to achieve tactical and strategic objectives. The problems of cost-benefit analysis in this area are described, but it is felt that such methods help clarify alternatives and challenge effectively preconceptions.

M010.0120 Clark, John J. *The New Economics of National Defense.* New York, Random House, 1966.

The management of national defense by systems analysis.

M010.0140 Colm, G. and Helzner, M. *General Economic Feasibility of National Security Programs.* Baltimore, Johns Hopkins University, Operations Research Office, May 1957.

The effects upon the national economy of expenditures for military programs are considered for four levels of defense spending. The lowest is the 1957 level and three step increments are postulated. The effect of such increases upon inflation is examined. The effects of tax cuts are also considered.

M010.0160 Curry, D.A. *Costing Concepts for the Defense Programs Management System.* Stanford Research Institute Memo Report Number SD-84. Stanford, California, Stanford Research Institute, March 1962.

Describes the military budget, defense fiscal processes and their application to forecasting program costs. The concept and use of incremental costs are also discussed. The most appropriate cost is the incremental cost with indication of the time phasing. Examples for the use of obligational authority, obligations and applied costs are given, along with a description of the program budgeting system in the defense establishment. The problem of supporting data through properly-structured accounting records and the devising of cost categories is considered.

M010.0180 Enthoven, Alain C. "Economic Analysis in the Department of Defense." Address by the Deputy Assistant Secretary of Defense (System Analysis) before the American Economic Association, Pittsburgh, Penna. December 29, 1962, Washington, D.C., Department of Defense, 1962. Also in *American Economic Review,* Vol. 53, (May 1963), 413-423.

M010.0200 Fisher, G.H. *The New OASD (Comptroller) Programming/Budgeting Process.* A lecture for the AFSC Cost Analysis Course. RM-3048-PR. The RAND Corporation, Santa Monica, California, March 1962. (DDC No. AD 279-597).

Describes the OASD (Comptroller) program budgeting system introduced in DOD in 1961. The fundamental purpose of the system is to provide the Secretary of Defense and his military advisors with a better basis for making major program decisions. Such decisions include (1) the choice among future weapon systems, (2) their force size, and (3) the selection of operational concepts. The organization established to operate the system is described, together with the experience of the first program budgeting cycle for fiscal year 1963.

M010.0220 Fisher, G.H. *Some Comments on Program Budgeting in the Department of Defense.* P-2721. The RAND Corporation, Santa Monica, California, March 1963. (DDC No. AD 402-137).

Contains a discussion of the basic objectives of program budgeting. The fundamental purpose of the programming system is to provide the Secretary of Defense with a better basis for making major program decisions by providing financial and nonfinancial information in a more meaningful way. Another objective of the system is to integrate the planning/programming and the financial management functions. Future developments of the system are also discussed. Developments considered for the future include (1) supporting information systems, (2) a meaningful program element structure, (3) an effective program change system, and (4) an analytical capability for cost-effectiveness studies.

M010.0240 Heuston, M.C. *Concepts of Cost Analysis for the Defense Industry.* TM-3. Douglas Aircraft Company. Missile and Space System Division, Huntington Beach, California, April 22, 1963.

A number of the basic principles of systems cost analysis are discussed as well as its background and development. A description is given of both the DOD program budgeting system and the USAF program format. System costs are described as total force structure costs or total system costs. Cost elements and categories are defined and outlined. The need to define the scope of the military system as the basis of the system's cost and the problem of obtaining adequate data are discussed.

M010.0260 Hitch, C.J. *Economics and Military Operations Research.* P-1250. The RAND Corporation, Santa Monica, California, January 1958. Also, *Review of Economics and Statistics,* Vol. 40 (August 1958) 199-209.

An examination of some of the relations between operations research and economics. Operations research is defined as the use of systematic quantitative analysis to aid in the making of military and management decisions. Economics is described as a logic of choice rather than as a study of "those things that can be brought into relation with the measuring rod of money." The author suggests that an alliance between economics and military or governmental operations research may result in a new branch of endeavor, namely an economics of government expenditure.

M010.0280 Hitch, C.J. *Planning Defense Production.* P-105. The RAND Corporation, Santa Monica, California, September 1949.

A talk delivered in late 1949 on the production problems of an advanced defense economy. The method considered is one in which the defense resources or budget is allocated among the production of the various goods and services contributing to the nation's security.

M010.0300 Hitch, C.J. "Plans, Programs, and Budgets in the Department of Defense," *Operations Research,* Vol. 11, (January-February 1963), 1-17.

M010.0320 Hitch, C.J. *Statement of Assistant Secretary of Defense Charles J. Hitch Before the Military Operations Subcommittee of the House Committee on Government Operations: Description of the Department of Defense Program Budgeting System,* July 25, 1962. House of

Representatives, 87th Cong., 2nd Sess., U.S. Government Printing Office, Washington, D.C., 1962.

This statement presented before the Congress describes the Department of Defense program budgeting system. The discussion concerns (1) the five-year program package concept, (2) fiscal controls and cost-effectiveness analysis, and (3) the presentation of information to the Secretary of Defense for decisions. The bringing together of previously separate functions of budgeting and programming is described. The functional arrangement of the DOD budget does not focus on forces and military programs in relation to missions. This need to relate costs to effectiveness is discussed. The program budgeting system is designed as an aid to the planning, execution, and control of defense programs. It is not a substitute for budgeting or for military planning but is a link between the two. The planning-programming-budgeting procedure facilitates the performance of cost-effectiveness analysis, since it brings together both programs and costs in the context of military missions.

M010.0340 Hitch, C.J. and McKean, R.N. *The Economics of Defense in the Nuclear Age.* R-346. The RAND Corporation, Santa Monica, California, March 1960. (DDC No. AD 243-098).

In Part II the need for resource analysis in military planning for the nuclear age is described as stemming from our need to plan forces for deterrence and limited conflicts, and not, as in the past, from how to mobilize our reserve strength. The problem in planning is the monetary restraint, not that of specific resources. The GNP and its relationship to the military budget are considered. The efficient use of military (and other government) resources is a special problem because of the absence of built-in mechanisms, such as those in the private sector of the economy, which lead to greater efficiency. In the absence of a price mechanism or competitive force to insure that governments carry out each function at a minimum cost, resource allocation becomes a major problem. A discussion is included of optimal, efficient and feasible solutions to allocation problems through the use of economic concepts such as indifference curves.

M010.0360 Hoag, M.W. *Some Complexities in Military Planning.* P-1531. The RAND Corporation, Santa Monica, California, December 1958.

An application of economic theory to show some prevailing oversimplifications in military discussion. Requirements and priority approaches to military allocations are criticized, and the complications introduced by increasing and interdependent returns are illustrated. Some implications for defense doctrine and organization are presented.

M010.0380 Hoffman, Fred S. "The Economic Analysis of Defense: Choice Without Markets," *American Economic Review,* Vol. 49 (May 1959), 368-379.

The application of some of the more general concepts and propositions of economic theory to military decision-making, with particular attention given to the allocation of scarce resources for research among competing uses. Research on defense problems must be carefully defined by the construction of a preference ordering, a knowledge-getting process to discover more about alternatives. In turn, this knowledge suggests new objectives and instrumentalities to make a preference ordering possible in the face of inherent uncertainties. Objectives of this research must be appropriately modest by measuring our desire for ever better decisions against the limited resources available to improve these decisions.

M010.0391 Kaufmann, W.W., "Cost and Effectiveness," in *The McNamara Strategy,* New York, Harper & Row Publishers, 1964, Chapter 5.

This chapter consists of a description of the Department of Defense planning-programming-budgeting system. The purposes and concepts of the system introduced by Secretary McNamara are discussed. The research and development, investment, and operating cost categories are described. The Five-Year Force and Financial Plan is described as the product of the system. A discussion is included of the application of the DOD system to the planning of forces.

M010.0400 McKean, R.N. *Economics of Defense.* P-2936. The RAND Corporation, Santa Monica, California, July 1964.

An examination of the economic aspects of defense planning. The author discusses resource management, program budgeting, cost-benefit analyses, and institutional arrangements.

M010.0420 McKean, Roland N. "Evaluating Alternative Expenditure Programs," Universities-National Bureau Committee for Economic Research, *Public Finances: Needs, Sources, and Utilization; A Conference.* Princeton, N.J. Princeton University Press, 1961. P. 337-364.

A discussion of the defense budget and activities to evaluate alternative expenditures for governmental operations. The costs and gains of various programs are discussed, together with breakdowns of cost and indicators of performance in recent budgets and improvements of these performance indicators. The analysis shows that measurements for many governmental operations can be devised that more closely approximate their value.

M010.0440 Medley, Porter Nelson, Jr. *A Concept for National Defense.* Master's thesis, Oklahoma State University, Stillwater, May 1965. (DDC No. AD 612-067).

The objective of this report is to develop a concept for resource allocation to achieve a more desirable cost effectiveness ratio for weapons of peace-keeping capability. The objective is not to criticize current concepts, policies, strategies, or methods. The purpose is purely exploratory – an attempt to determine whether basic concepts or precepts of national defense are compatible with the present environment.

M010.0460 Mosher, Frederick C. *Program Budgeting: Theory and Practice, with Particular Reference to the U.S. Department of the Army.* Public Administration Service, 1954.

The integration of budgeting and planning are discussed, and good examples are provided for every theoretical suggestion. It is proposed to establish two budgets: a planning budget imposed on the departments from above and an administrative budget drawn up by department heads for the efficient allocation of funds provided for in the planning budget.

M010.0480 Novick, David. *Federal Spending for National Security.* P-1197. The RAND Corporation, Santa Monica, California, October 1957.

A 1957 discussion of seven factors expected to influence current and future trends in federal spending for national security purposes: (1) external political, military, or economic pressures; (2) the possiblity of a mutual inspection system leading toward weapons control; (3) possible

decisions to use international forces in place of national ones; (4) changing technology that results in more effective weapons; (5) domestic demands for economy in government; (6) an inflation or deflation in the price level within the United States; and (7) the continuing impact of budget and procurement decisions made in earlier years.

M010.0500 Novick, D. *A New Approach to the Military Budget,* RM-1759-PR. The RAND Corporation, Santa Monica, California, June 1956. (DDC No. AD 112135).

Describes the existing federal budget structure as it applies to military programs. The structure is described as not having kept up with military decision-making needs. For effective use by management, the budget should be presented in terms of specific and understandable objectives appropriate to the level of decision concerned. It should also provide for translating objectives into comprehensive and comparable units of financial measurement, and should permit expenditure implications to be projected over an extended period of time.

M010.0520 Novick, D. *Program Budgeting in the Department of Defense.* RM-4210-RC. The RAND Corporation, Santa Monica, California, September 1964. (DDC No. 604388).

Discusses the introduction and development of the program budgeting concept in the Department of Defense. The significant feature of the new system is described as its approach to decision-making and control of defense expenditures. Planning is considered in long-range terms of missions, forces, and military systems. The annual budget is a part of a long-range plan. Since the system requires a continuous type of budget review, a program change proposal system has been developed. Thresholds have been established to concentrate attention on major programs, and the actual accomplishment of approved programs against milestones.

M010.0540 Novick, D. *Program Budgeting: Long-Range Planning in the Department of Defense.* RM-3359-ASDC. The RAND Corporation, Santa Monica, California, November 1962. (DDC No. AD 289851). Also published as "Planning Ahead in the Department of Defense," *California Management Review,* Vol. 5, No. 4, (Summer 1963), 35-42.

The planning and programming process that was introduced in the Department of Defense in early 1961 is described in this memorandum. In the system, planning is considered in long-range terms of missions, forces, and weapon systems, i.e., resource outputs, rather than in the standard input categories such as procurement, construction, and personnel. The annual budget becomes an increment of a longer-range plan. The procedure requires a continuous review which is provided by the program change control system. Milestones are established to mark the events and activities on which the financial plan is based, and actual accomplishment is reviewed against such milestones.

M010.0543 Novick, D. *Resource Analysis and Long-Range Planning.* RM-3658-PR. The RAND Corporation, Santa Monica, California, June 1963. (DDC No. AD 406-844).

Program budgeting, cost-effectiveness, and cost analysis are terms used frequently in military research programs. This RAND Memorandum contains a discussion of these terms. The purpose and features of program budgeting are discussed within the context of decision-making for the military. Cost-effectiveness analysis is described as a method of analysis for the purpose of minimizing cost at specified levels of effectiveness or to maximize effectiveness with resource levels fixed. The role of cost analysis in the problem of choice among alternatives is discussed. The categories of cost–R & D, investment, and operating–are described and their significance is discussed. Sample formats for these categories and their elements are included.

M010.0560 Proschan, A. "Programming System of the Department of Defense," *Armed Forces Comptroller,* Vol. 8, No. 3 (September 1953), 14-21.

Describes the Department of Defense programming system. Its origins are traced from recommendations dating back to 1951. The purposes of the system are explained, together with its program element and package arrangement. The initial submission of departmental programs and subsequent modifications to the system are described. The Program Control System to keep programs current is explained.

M010.0580 U.S. Department of Defense. *Programming System for the Office of the Secretary of Defense,* Study Report. Washington, D.C., May 1962.

This study was prepared in the Office of the Secretary of Defense at the completion of the first cycle under the new DOD program budgeting system. The report is presented in four sections with appendices. The new programming system is described, and definitions given for the program elements and resource categories. The cost estimates for elements and their analysis are discussed, together with the development of the system for the future. Information needed to support program budgeting and a system for providing it are examined.

M010.0600 U.S. Department of Defense. *United States Department of Defense Planning-Programming-Budgeting System.* Presented by W. Lynn Johnson. Washington, D.C., 1965.

M010.0620 U.S. Industrial College of the Armed Forces. *A Modern Design for Defense Decision; A McNamara-Hitch-Enthoven Anthology.* Edited by Samuel A. Tucker, Washington, D.C., 1966.

M010.1000 Yates, E.H. *The Role of Cost Analysis, Defense Research Corporation,* Santa Monica, California, Internal Memorandum IMR-183, October 1964.

Contains a discussion of the general procedures involved in cost analysis and the derivation of costs in the overall procedure. Applications of cost analysis are presented, followed by a discussion of accuracy and future developments in cost analysis. The development of cost-estimating relationships using a statistical approach is described. Two basic applications of cost analysis are discussed, which include (1) system selection to identify the best combination of system variables and (2) system comparison to select from among alternative systems. Future work in cost analysis is considered to be increased effort to improve the accuracy of estimates. Appendices are included presenting independent variables, typical cost elements, estimating equations, cost quantity curves, system costs and force projections.

M020.0032 Ancker, Jack P. and Benefield, Bruce S. *Alternative Methods of Reducing the Ultimate Costs to the Government of Acquiring and Maintaining Items in the Inventory.* Air Force Institute of Technology, Wright-Patterson AFB, Ohio, June 1964. (DDC No. AD 443-005).

Efforts were directed toward a study of alternative methods by which the services can procure supplies within the intent of the Congress and the provisions of armed services procurement regulation (ASPR), and still achieve the goal of reducing inventory and the cost of acquiring and maintaining this inventory.

M020.0100 Deavers, K.L. and McCall, J.J. *An Analysis of Procurement and Product-Improvement Decisions.* RM-3859-PR. The RAND Corporation, Santa Monica, California, December 1963.

Presentation of a framework for the analysis of procurement and product-improvement for the Air Force. Questions to be raised before the procurement or modification of a weapon system are specified. Weapon system reliability and maintainability are stressed.

M020.0217 Fray, Lionel L., Briggs, Warren G., and Russell, John R. *Cost/Effectiveness and Utility Functions for Incentive Structures.* Harbridge House Inc., Boston, Mass., 1966. (DDC No. AD 485-572).

The development of incentive structures to be employed in R & D contracting requires an analytic expression of the buyer's preferences for alternative outcomes, which, in effect, requires the buyer to develop a utility function. The paper first describes the theory by which a buyer aligns his utility with that of the seller, creating the incentive structure. This can be simplified when cost/effectiveness analyses can help relate increments of performance and time (delivery) to dollars of incremental cost. When this approach cannot be employed, a utility function must be developed by other means, such as an iterative comparative preference method. An extensive example of such an application is described using a method that employs a computer to help the decision-maker develop an analytic utility function in three dimensions. The mathematical approach can be extended for analytic utility functions in additional dimensions. (Author)

M020.0225 Friedland, E.I. and Miller, J.R., III. *A Search for Computer Cost Estimating Relationships.* W-6595. The MITRE Corporation, Bedford, Mass., October 1965.

Describes an effort to obtain and develop cost estimating relationships (CERs) to predict the military acquisition cost of future computer systems. A detailed description of the procedures used in generating CERs is presented. The underlying philosophy of the choice of methodology is discussed, along with guidance as to how the results should be interpreted. The study is concerned primarily with large-scale general purpose computers. The study is also concerned with future digital computers of the scientific type, as opposed to business type systems. A bibliography of reference materials is included.

M020.0311 Lear Siegler Inc. *Prover, Procurement, Value Economy, Reliability.* Grand Rapids, Michigan, March 1962. (DDC No. AD 459-757).

Real competitive bidding and true low-dollar awards are essential to efficient spending of defense funds and to the free enterprise system. The prover concept not only recognized this fact, but, by providing specific criteria of definition and measurement ensures maximum realization of its fullest meaning.

To apply the prover concept the reliability index must be defined during the R & D phase, and subsequent controlling technical documents must specify required reliability levels. Demonstration of reliability compliance through adequate tests must be required at the time of design qualification, just as it is for other performance parameters. Subsequently, the reliability index demonstration is required through continuous acceptance sampling and periodic requalification throughout the life of a production contract.

M020.0362 Presutti, Victor J., Jr. and Irving Katz. *Practical Aspects of Economic Order Quantities.* Operations Analysis Office, Air Force Logistics Command, Wright-Patterson AFB, Ohio, May 1965. (DDC No. AD 615-828).

The study was designed to improve logistic rationing procedures. In the process of making the changes several special purpose estimates of the demand rate were used, a departure from typical multi-purpose applications of a single estimate. A computer simulation of the new procedures is described. It reveals that the changes simultaneously reduce costs and increase support effectiveness. Initial efforts to improve safety levels are also discussed. These are made a function of the unit cost for each line item, in an effort to obtain the most protection per dollar invested, across the entire inventory of almost a million line items.

M020.0400 Novick, D. and J.Y. Springer. "Economics of Defense Procurement and Small Business," *Law and Contemporary Problems,* Vol. 24, No. 1 (Winter 1959), 118-131.

Examines the magnitude and nature of military procurement and the special commercial considerations involved. The analysis concentrates on equipment, including military materials, components, special products and services required for weapons and their directly related equipment. The weapon-system concept of procurement management is described. Also discussed are the national security considerations which make a distinction between the market for military goods and that for normal commercial contracts.

M020.0800 Peck, M.J., and Scherer, F.M. *The Weapons Acquisition Process: An Economic Analysis,* Cambridge, Massachusetts, Harvard University Press, 1962.

This volume is primarily concerned with government-business relationships in the development and production of weapons. The weapons acquisition process, using private firms for most of the effort, includes the conception, development, and production of technically advanced weapons for use by the armed forces. The process consists of the flow of decisions and activities of government agencies and defense contractors. Economic analysis is used to examine the effects of the acquisition process on the quality, time and cost of the weapons programs. The book includes a detailed compilation of the histories of 12 weapon system developments covering the three services. Also discussed are the constant presence of uncertainty in the weapon acquisition process and the absence of a market to integrate the needs of the government with the objectives of contractors. A definition of the efficiency of the process is presented together with a method for its measurement.

M020.1000 U.S. Army Missile Command. Redstone Arsenal, Alabama. *The Experience Curves,* Directorate of Procurement and Production, Research and Planning Section, Vol. I (DDC No. 612-803), Vol. II September 1962. (DDC No. 612-804).

Contains an explanatory introduction to the theory and computation of experience curves, followed by machine tabulations of experience curve factors. Volume I includes values for curves over the range of 67 percent through 84 percent. Volume II includes values for curves over the range of 85 percent through 99 percent. Procedures are presented for the use of curves.

Value Engineering

M021.0100 American Ordnance Association, Office of the Assistant Secretary of Defense (Installations). *Fringe Benefits of Value Engineering.* A survey prepared by the technical subcommittee, AOA special committee on Value Engineering, Washington, D.C., May 1964. (DDC No. AD 605-454).

The Department of Defense is currently taking steps to greatly increase the application of value engineering techniques to defense equipment and supplies.

Since it is a widespread feeling among persons not directly involved in value engineering work that value engineering 'cheapens' a product and lowers its performance capabilities, it was requested that the American Ordnance Association undertake a study of representative items, arbitrarily selected, to determine whether or not this feeling was true. It was further suggested that the study document the impact in terms of such factors as reliability, maintainability, and other fringe effects.

The special committee on value engineering established the survey format and boundaries and actually applied value engineering principles to preparation of the survey. Some of the problems encountered in preparing this survey were ones of definition.

For example, although it is clear what the difference is between a Class I and a Class II change to the individual contractor, it is possible that a Class I change for a subcontractor would be a Class II change for a prime contractor. The ground rules established to this problem were: if the change did not require a contract modification to the prime contract, it was counted as a Class II change.

M021.0114 Fallon, C. "Practical Use of Decision Theory in Value Engineering," *Value Engineering,* Vol. 2, No. 3 (May 15, 1964), 45-9.

Method of value analysis is described that incorporates in single tubular algorithm two distinct matrices and column vector by which one matrix is multiplied to obtain other; elements of multiplying vector are aligned in row form over columns which they multiply, and algorithm provides place for new elements, clearly establishing their relationship to all facts being considered. 29 refs.

M021.0118 Eades, B.W. *Economics of Design Through Value Engineering.* Society of Automotive Engineers – Paper S329. Meeting 4-5 1962. Central Illinois Section, 1962.

Account of methods and applications of principles and recommendations made with regard to methods to obtain 'lowest total cost to achieve essential function' of product or system manufactured.

M021.0120 Groudan, Jules. *The Application of Defense Value Engineering.* TM-1662. Picatinny Arsenal, Dover, N.J., January 1966. (DDC No. AD 624-810).

This report is intended to serve as an adjunct to a program of across-the-table discussions with contractors in an effort to resolve some of the prevailing problems at the Government/industry interface since experience clearly indicated that many contractors as yet are not convinced that the Government is in earnest in its desire to implement an effective Department of Defense-wide Value Engineering Program as outlined in Defense Procurement Circular 11. (Author)

M021. 0140 Groudan, Jules. *Value Engineering and the Importance of Engineering Documentation.* PATM1391. Ammunition Engineering Directorate Picatinny Arsenal, Dover, N.J., April 1964. (DDC No. AD 600–394).

Value Engineering is often defined as a new name for the old game of cost reduction, a rearrangement of familiar design concepts, but worst of all a synonym for production and industrial engineering. The improvement areas considered by the value engineer and generally applicable in its broader sense to industry as obvious areas of excessive cost are: (1) design simplification of metal parts; (2) materials; (3) processes and manufacturing methods; and (4) documentation cost. (Author).

M021.0151 Hall, T.P. and Robertson, L.H. "Evaluating Value Analysis," *NAA Bulletin,* Vol. 46, No. 32 (February 1964).

M021.0157 Hines, R. and Leshner, E. "Relationship of Value Engineering and Cost Effectiveness," *Journal of Value Engineering,* Vol. 2, No. 4 (August 15, 1964), 13-15.

Study of military worth (in respect to total cost) before project has been initiated is advised: efforts applied to cost sensitive areas outweigh similar time spent on those relatively cost insensitive; cost effectiveness study can locate sensitive costs; establish possible changes in program, accumulate and bring to bear information not otherwise available.

M021.0159 "How Valuable is Value Analysis?" *Business Week* (May 15, 1965), 78.

M021.0160 Huss, Harry O. *Value Analysis (Value Engineering). A Technique for Obtaining More Value for the Defense Dollar.* ENGS-SR-1. Army Chemical Center, Md., March 1963. (DDC No. AD 609-520).

Value analysis includes actions that identify and eliminate all unnecessary costs in design, development, and procurement of army material without sacrificing essential quality or performance. Contents: value analysis considerations; value analysis fundamentals; value analysis job plan; value analysis techniques; contracting for value analysis; manufacturing processes; value engineering worksheets; examples of value analysis cost reductions of chemical-biological-radiological material and bibliography on value analysis and value engineering.

M021.0180 Kelley, Robert W. *Value Engineering and Experience Curve Predictions.* Army Missile Command, Redstone Arsenal, Ala., Directorate of Procurement and Production, September 1965.

(DDC No. AD 625-984).

The booklet illustrates situations in which experience curve techniques may be applied as an aid in analyzing a VECP (proposal by a contractor for a change in a value engineering clause). The booklet deals with general situations which one might incur in dealing with value engineering problems. The method of dealing with the experience curve techniques and value give a sample solution using these figures. The formal equations and theory used for the solutions are given in a separate section from the examples. The solutions are directed toward obtaining the total savings and the average savings per unit for some given quantity as the result of a value engineering change made at some point in production.

M021.0200 Lockheed Missiles and Space Co. *Missile Systems Division Value Engineering.* Sunnyvale, California, September 1961. (DDC No. AD 605-162.

The MSD value Engineering Program is directed by a value engineering control committee (VECC). This committee is composed of responsible personnel from the major operating segments involved in the Polaris program, and is under the chairmanship of the manager of production support. The VECC performs the following functions: (1) Establishes and implements procedures for directing and coordinating the VE program. (2) Monitors VE activities and provides guidance where needed. (3) Approves VE reports which are to be submitted to management. (4) Reviews any VE problems which may arise and renders decisions when necessary to solve these problems. (5) Ensures that all the required functions listed in management policy and procedure number 9.61, 'Value Engineering' are carried out satisfactorily within the Polaris organization.

M021.0220 Martin Marietta Corporation. *Program 624A Value Engineering Report.* Denver, Colo., October 1964. (DDC No. AD 450-436).

This report presents the 624A program value engineering (VE) activities and accomplishments for the period of 1 July through 30 September 1964. Also included in this report is a summary of all cost savings on the 624A program as a result of VE efforts.

M021.0240 Martin Marietta Corporation. *Program 624A Value Engineering Report.* Denver, Colorado, January 1965. (DDC No. AD 455-586).

Program 624A Value Engineering Report.

M021.0260 Martin Marietta Corporation. *Program 624A Value Engineering Report.* Denver, Colo., April 1965. (DDC No. AD 461-794).

Program 624A value engineering report.

M021.0262 Miles, L.D. *Techniques of Value Analysis and Engineering.* New York, McGraw-Hill, 1961.

M021.0267 Moon, J.W. *How to Sell Those Value Studies.* ASTME 32nd Annual Meeting – Collected Papers, Vol. 64, Book 5, Paper 609, 1964.

Established techniques for good salesmanship discussed with reference to selling value analysis concept: deflation of problem; reasons for management rejection; design parameters.

M021.0280 Nash, Albert G. *Value Responsibility of the Designer.* Picatinny Arsenal, Dover, New Jersey, Ammunition Engineering Directorate. December 1965. (DDC No. AD 625-659).

The report gives a realistic background picture of ammunition design. This picture – while positive in respect to achieving further value – also indicates many of the limitations and pitfalls which personnel must face if successful work is to be accomplished. This presentation was given to the Value Engineering Seminar at Iowa Army Ammunition Plant at Burlington, Iowa, on October 28, 1965.

M021.0300 Pearlman, A.L., and Rensen, J.S. *Minuteman VE Program Review – Fiscal Year 1963.* School of Medicine, Tufts University, Boston, Massachusetts, September 1963. (DDC No. AD 429-980L).

Review of the program revealed that 11 of the 13 contractors that did not have value activities on their Minuteman program have developed active value programs and two have not. The Air Force will receive $223,140 as their share of six approved value engineering change proposals (VECP's) and $3,083 million in lower cost of performed contracts as their share of contractor-implemented cost avoidance (non-ECP) changes for a total direct program cost of $865,000 (or a ratio of more than 3:1). Three of the associate contractors have extended to their subcontractors the government value engineering incentive saving/sharing clause. Early results indicate that broadened coverage is desirable.

M021.0317 Pinkowski, R.J. *Developing Alternatives – A Necessary Aspect of Value Engineering.* ASTME Creative Manufacturing Seminars, 1963-64.

Value concept is based upon premise that there are better ways to accomplish given function; development of alternative solutions is most important aspect; methods for working up alternative solutions are grouped under general concept of "creative" thinking and suggested procedures outlined; initially, problem is defined, pertinent facts gathered, and then individual and/or group thinking is focused upon problem; all possible approaches considered: attitude blocks and ways to becme more "creative" discussed.

M021.0320 Purvis, R.E. and McLaughlin, R.L. *Criteria for Value Engineering. Phase I. Feasibility Study,* Technical Report, RCA Service Co., Alexandria, Virginia, February 1966. (DDC No. AD 630-207).

The state of the art of value engineering is summarized. A value analysis technique is proposed with the following characteristics: (A) Quantification of value consistent with established USAF specification of system utilization. (B) Value parameters which are predictable and measurable. (C) Systematic method of quantitative analysis which permits practical optimization in the least cost sense consistent with system value. (D) Technique structure which permits design tradeoff of discrete alternatives relating to cost and system value parameters. (E) Method of cost analysis which permits optimization with respect to total cost and is consistent with both design and operational value parameters. (F) Method of cost analysis based on difference principles which permits decisions through dominance of one alternative to another. (G) General method of analysis which permits cost in time and singling out areas significant cost differences between alternatives.

M021.0331 Riordan, J.J. "Value Engineering for Information Systems," *Journal of Value Engineering*, Vol. 3, No. 1 (First Quarter, 1965), 26-28.

Management policies and practices, ideas, and their interplay; review of experience of United States Department of Defense in value engineering; review of some selected Department of Defense management innovations that are distinct from value engineering but of same genre; identification of some inter-relations; policies, programs and practices discussed are of primary interest to defense community but might advantageously be analyzed, collectively and individually, for their applicability to industrial affairs and to information technology and management specifically.

M021.0338 Sergent, G.W., "Value as Design Parameter in Aerospace Systems Development," *Journal of Value Engineering*, Vol. 3, No. 3 (Second Quarter 1965), 44-45.

Cost models provide system oriented cost targets from system concept through completion of design, provide cost viability in relation to original customer established cost target for system, permit early identification of items which could exceed relative value thus allowing opportunity for specific application of value engineering plan and techniques and display results in a simple fashion for use with other tools used in decision-making; method of improving approach to relative value systems analysis is evaluated.

M021.0340 Swain, Raymond J. *In-House Value Engineering*, Air Force Weapons Lab, Kirtland AFB, New Mexico, June 1965. (DDC No. AD 618-070).

Value engineering (VE) is an organized effort directed toward achieving the required function of defense hardware at the lowest overall cost. Defense hardware items are especially amenable to the VE process since the methods used in their development often lead to massive unnecessary costs. A thorough VE program can reduce the cost of most existing designs by 40 percent. The basic process of VE begins with product selection. Next the function of the entire assembly and each part within the assembly are listed (using one verb and one noun only). The next step is the gathering of all possible information on the design including a complete cost breakdown on all parts. At this point alternatives are proposed to accomplish the required function (including maintainability and reliability) of the item. This is a highly creative process and group efforts, such as brainstorming, can be employed to advantage. The objective is to include in the list the simplest possible methods of accomplishing the required function and to utilize methods with the lowest possible manufacturing cost. The historical and theoretical value standards are quite useful here and in making a thorough cost analysis of all workable alternatives. Those alternatives that are seen to result in significant saving are tested and verify that they fulfill all functional requirements. The final step is proposal submission and necessary follow-up to implement any design changes.

M021.0360 TRW Space Technology Labs. *Instructor's Notes for Case Problems in the Contractual Aspects of Value Engineering.* Training Guide Supplement MB, Los Angeles, California, April 1964. (DDC No. AD 609-883).

This supplement contains answers, notes, and charts for the nine case problems on the contractual aspects of value engineering, which are presented in chapter 5 of the DOD training guide for the management of value engineering programs in defense contracts.

These notes are based upon interpretation of revision 3, dated 15 November 1963, of part 17 of section 1 of the Armed Services Procurement Regulation.

M021.0380 U.S. Department of the Army. Army Missile Command. *Value Engineering Symposium on Advancement in the State of the Art.* Redstone Arsenal, Alabama. 18-19 November 1964. (DDC No. AD 616-516).

The three-fold purpose of the symposium was to induce cross-fertilization among value engineers by presentations and discussions of the latest techniques and trends, to emphasize the DOD policy of raising both the stature and productivity of value engineering, and to explain the intent and interpretation of current armed service procurement regulations concerning value engineering. In a further effort to provide a means of exchanging useful information, this report was prepared. Included in this report is a copy of each paper accepted by the symposium program committee along with a brief biography of each of the authors. Time limitations did not permit each paper to be presented at the symposium but each one is included here in order to give the complete picture of the state of the art of value engineering.

M021.0400 U.S. Department of Defense. *DOD 'In House' Value Engineering Conference.* Conference Presentations. Pentagon Building, 18-19-20 February 1964, Washington D.C., February 1964. (DDC No. AD 482-096).

Value Engineering Conference.

M021.0420 U.S. Department of Defense, Office of the Assistant Secretary of Defense (Installations and Logistics). *DOD 'In House' Value Engineering Conference*, February 18-20, 1964. Conference sponsored by Director of Productivity and Value Engineering, February 1964. (DDC No. 602-841).

The presentations described applications of VE techniques at DOD installations that included several air material areas, arsenals, shipyards, repair and overhaul facilities, and supply depots. Scores of examples of successful VE applications were discussed.

M021.0440 U.S. Department of Defense, Assistant Secretary of Defense Installations and Logistics. *The Management of Value Engineering Programs in Defense Contracts.* Washington, D.C., Training Guide, April 1964. (DDC No. AD 604-662).

Uniform instruction in value engineering program management for Department of Defense personnel is provided. The requirements of those who will be engaged in negotiating, reviewing and approving contractor value engineering efforts are listed.

The fundamentals of the value engineering theory and details of value engineering program tasks are presented. Contractual aspects based upon the armed services procurement regulation are discussed in detail. Guidelines are offered for some of the administrative and operational facets of value engineering programs.

M021.0460 U.S. Department of Defense, Assistant Secretary of Defense Installations and Logistics. *Principles and Applications of Value Engineering.* Washington, D.C., Training Guide, 1964. (DDC No. AD 604-663).

The following objectives of this training guide are provided: (A) A complete understanding of the fundamentals of the value engineering method, (B) A familiarity with some of the ancillary material necessary to its performance, and (C) A description of value engineering programs. Some material on value engineering program management is provided, such as contractual aspects, organization and assessment of results. The subject matter is presented in generic form.

M021.0467 "Value Analysis Case Histories," *Purchasing*, Vol. 56, No. 34 (May 18, 1964), 479.

M021.0480 Whelchel, Henry C., Jr. and Zipperer, William R. *An Application of Value Analysis Concepts Toward More Efficient Attainment of Fighter Squadron Objectives.* Naval Postgraduate School, Monterey, California, Master's Thesis, 1965. (DDC No. AD 475-274).

During the last two decades, value analysis/engineering has emerged as an effective cost reduction discipline in product refinement, purchasing, and national defense. Within this paper, the concepts and methods of application of value analysis/engineering are reviewed. The process of value analysis is considered to be applicable to a fighter aircraft squadron for the purpose of achieving higher combat readiness within time and resource constraints.

A basic plan is presented to provide the fundamental structure and method of implementation of the technique for squadron organizational improvement.

MILITARY SYSTEMS EVALUATION

M100.0000 Fisher, G.H. *A Discussion of Uncertainty in Cost Analysis.* RM-3071-PR. The RAND Corporation, Santa Monica, Calif., April 1962. (DDC No. AD 279-936). Also published as Chapter VI, "The Problems of Uncertainty", in J.P. Large, (ed.), *Concepts and Procedures of Cost Analysis.* RM-3589-PR. The RAND Corporation, Santa Monica, Calif., June 1963, p. VI-1-VI-26. (DDC No. AD 411-554).

Contains an exploratory discussion of the problem of uncertainty in the cost analysis of future military systems and forces. A number of earlier studies of costing uncertainties are considered. The major sources of uncertainty–requirements uncertainty and cost-estimating uncertainty–are outlined, and various proposals for their treatment are discussed. Sensitivity analysis, suggested as a possible solution, is also described.

M100.0100 Alderson, Donald J., Brush, Leonard M., Combs, Carlton E., Jr. and Hall, Donald L. *Cost-Effectiveness Analysis of a Proposed Intelligence Subsystem of the Command Control Information System.* Combat Operations Research Group. Technical Operations, Inc., Fort Belvoir, Virginia, July 1964. (DDC No. AD 477-468).

The cost and effectiveness of a proposed intelligence subsystem were estimated in order to determine what modifications, if any, should be made. The principal basis for comparison was an augmented manual intelligence system.

M110.0114 Bell, Chauncy F., Kamins, and Milton. *Determining Economic Quantities of Maintenance Resources: A Minuteman Application.* The RAND Corporation, Santa Monica, California, January 1963.

This memorandum introduces a technique for computing manpower and equipment requirements that takes into account three critical and frequently overlooked factors. These are: the randomness of the failure patterns–the uncertainty of the time any particular malfunction will occur; the workshift policy–when maintenance personnel are on duty; and the cost-effectiveness trade off–the marginal increase in a system capability weighed against the cost of providing a marginal increase in resources. The quantities of maintenance personnel and ground equipment estimated with the technique presented here will economically meet anticipated requirements within the accuracy limitations of the three inputs necessary to the computation. These are: failure rate or reliability, repair time or maintainability, and cost.

M100.0120 Alderson, Donald J., Brush, Leonard M., Combs, Carlton E., Jr. and Hall, Donald L. *Cost-Effectiveness Analysis of a Proposed Intelligence Subsystem of the Command Control Information System. Annexes.* CORG-M-173-Annexes. Combat Operations Research Group Technical Operations, Inc. Fort Belvoir, Virginia. May 1964.

M100.0131 Dordick, H.S. *An Introduction to System Effectiveness.* P-3237. The RAND Corporation, Santa Monica, Calif., October 1965. (DDC No. AD 622-417).

The paper is an introduction to a working session on 'system effectiveness', defined by the office of Naval Material as 'a measure of the extent to which a system can be expected to complete its assigned mission within an estimated time frame under stated environmental conditions'. For systems effectiveness, not only must reliability and maintainability parameters be considered, but each of these must be traded off with performance criteria. Defining effectiveness measures for the designer shifts from the research orientation of looking for basic principles to techniques for organizing design performance, managing the design performance, and setting up a structure of project management within which the designer must work.

M100.0132 Barfoot, Charles B. *A Preliminary Cost-Effectiveness Handbook.* Technical Operations Research, Arlington, Massachusetts, November 1963. (DDC No. AD 446-700).

This preliminary handbook was developed for use by United States Army Combat Developments Command Field Agencies and AD HOC Study Groups in the preparation of cost-effectiveness studies. The handbook discusses the purpose of cost-effectiveness analysis, general methods for comparing alternative system, and the major elements of the analysis. Two examples of cost-effectiveness evaluations are presented. General references and a bibliography of published sources for cost data and of publications on systems and force structure costing are included.

M100.0140 "Defense Economics: Applying Economic Criteria," *American Economic Review*, Vol. 55 (May 1965), 416-438.

Contents.–Using costs to select weapons, by Stephen Enke.–Military cost analysis, by Robert N. Grosse and Arnold Proschan.–Discussion, by James R. Schlesinger and Rolf N. Piekarz.

M100.0160 Bovaird, R.L., Goldman, A.S., and Slattery, T.B. *Concepts in Operational Support Research.* RM-60TMP-70. *TEMPO,* General Electric Company, Santa Barbara, California, 21 November 1960.

This paper deals with concepts involved in the field of "Operational Support of Complex Military Systems." Operational support, as used here, refers to the process which has the objective of keeping system availability (or unavailability) at acceptable levels. An attempt is made to gather into a cohesive form those principles characterizing the new science which is envolving from integrated studies on reliability, maintainability, and logistics problems. The concepts presented here have been developed out of support studies of several current military electronic systems.

M100.0180 Bradley, B.D. *Building a New Force Structure Cost Analysis Model.* RM-4764-PR. The RAND Corporation, Santa Monica, California, October 1965.

A model is being designed to incorporate explicitly the analysis of non-weapon support activities. The concepts underlying the model are discussed. The model employs cost elements related to the budget/appropriation structure and end-product elements defined by organizations and their related equipment and activities.

M100.0200 Bradley, B.D., Clapp, R.E. and Petruschell, R.L. *A New Cost Model to Support Air Force Long-Range Planning.* P-3133. The RAND Corporation, Santa Monica, California, May 1965. (DDC No. AD 615-401).

Describes the concepts, structure, and objectives of a planned Air Force cost analysis model. The model is intended for use in estimating the costs of total force structures and will assist in the analysis of resource implications of planning alternatives. The paper contains descriptions of the long-range planning process, the place of cost-analysis in planning, and the general characteristics of cost modeling.

M100.0220 Broussalian, V.L. *The Evaluation of Non-Marketable Assets.* Research Contribution Number 15. Center for Naval Analysis, Washington, D C., June 1965.

Examines the applicability of discounting the value of military investments. Military investments are in non-marketable assets, and because of difficulties in evaluating such assets, discounting is found to be meaningless. It is maintained that the benefits and costs of a non-marketable investment must ultimately be evaluated directly and without the intermediate step of discounting. The ranking of systems whose benefits are specified can, however, be accomplished on the basis of the present value of their costs provided that the government borrowing rate is used as the discount rate. The meaning of present values in this case differs from their counterparts in marketable investments. They reflect the cost of obtaining the time-pattern of taxation deemed by the government to be desirable for financing the systems.

M100.0240 Bryk, Oliver. *An Approach to Force Composition Analysis.* Research Analysis Corp., McLean, Virginia, August 1965.

Contains a general summary of the elements of force analysis. Force analysis is described as an activity in the planning phase, which includes the design of alternate forces, each having some estimated future effectiveness and cost. The preferred future force is selected from among the alternatives by applying a criterion that specifies the relation between effectiveness and cost that will result in preference. The design of a criterion for preference is described as an essential and difficult element of force composition analysis.

M100.0260 Combat Operations Research Group Technical Operations, Inc., *Methodology Notebook for Action Officers.* Final Report. Fort Belvoir, Virginia, July 1965. (DDC No. AD 473-555).

Brief descriptions of operations research techniques are presented, including discussions of systems analysis, cost-effectiveness analysis, simulation, wargaming, field experiments, troop tests, and human factors. Particular emphasis is given to the military application of these research techniques. Appendices present case studies describing the contributions of operations research procedures to specific study programs of the United States Combat Developments Command.

M100.0280 Davis, H. *The Use of Cost-Effectiveness Studies in Military Decision-Making.* Operations Analysis Paper No. 1. Headquarters, United States Air Force. Washington, D.C., November 1961.

Evaluates the strengths and weaknesses of analytical studies in the military decision-making process. Limitations outlined include the difficulty of choosing a proper measure of effectiveness, a lack of operational experience which hampers the evaluation of advanced systems, the limited scope of available studies and the difficulty of fitting them into the military-political picture, and the difficulty of treating all the aspects of the study. Cost-effectiveness studies are described as useful inputs for decision-making but are not in themselves satisfactory for decisions in the broader aspects of total military problems.

M100.0300 Edwards, N.P. "On the Evaluation of the Cost Effectiveness of Command and Control Systems," *Proceedings of the Spring Joint Computer Conference.* American Federation of Information Processing Societies. Baltimore, Maryland, Spartan Books. 1964.

M100.0320 Eliel, L.F. *A Generalized Cost Model for Military Systems.* Aerospace Corporation, Bernadine, California, January 1962.

This paper contains a description of the major features of cost models. Various types of cost models are included. Relationships between system design, technology, and resource requirements are described. Marginal analysis as a resource allocation tool is discussed as an element of the model. The relationship between system costing and financial planning is described, as well as the use of models for resource allocation or economic planning activities.

M100.0340 Enthoven, Alain C. *The Mathematics of Military Pay.* Revised edition, P-1100. The RAND Corporation, Santa Monica, California, November 11, 1957.

The purpose of this paper is to explain the mathematical theory of maximization of military effectiveness within the limitations of a fixed budget and to show that the theory has an appropriate application in the pay question.

M100.0360 Enthoven, Alain C. *The Simple Mathematics of Maximization.* P-1833. The RAND Corporation, Santa Monica, California, November 1959.

An economic approach to the problem of military choice (namely, that of allocating a fixed budget among alternative strategic weapon systems, or of finding the maximum of some relevant measure of strategic airpower, given the limitation of a fixed budget). The complexity of military choice is discussed in terms of risk and uncertainty about nature, technology, and enemy reactions. As no simple formal model of choice is sufficient for a satisfactory analysis of most real military problems, this paper formulates part of the problems of choice in economic terms, that is, in terms of discovering the most effective uses of limited resources.

M100.0380 Enthoven, Alain C. "Systems Analysis and Military Decision Making," *Military Review,* Vol. 43 (January 1963), 10-17.

M100.0400 Enthoven, Alain C. "Systems Analysis and the Navy," *Naval Review,* (1965), 98-118.

Discusses the concept of systems analysis, examines its relationship to operations research, considers its strengths and limitations, and demonstrates its application to problems of determining the nature and size of naval forces.

M100.0412 Evans, George R. *Systems and Cost-Effectiveness Analysis: An Annotated Bibliography.* Lockheed Missiles and Space Company, Palo Alto, California August, 1966. (DDC No. AD 487-135L).

M100.0420 Firstman, Sidney I. and Jordan, Nehemiah. *Operational and Human Factors in Planning Automated Man-Machine Checkout Systems.* RM-2835. The RAND Corporation, Santa Monica, California, April 1962.

This memorandum, aimed at improvement of planning and designing of automated checkout and test equipment (ACE) for military systems, is part of a larger RAND study of automatic checkout equipment.

It is based on large measure on an extensive survey of automated checkout and test equipment as it has been used in the field, supplemented by study of human factors relevant to both the process of automating such equipment, and the subsequent operation of the ACE, in furtherance of overall effectiveness of military systems.

M100.0440 Fisher, G.H., *Distribution of Indirect Costs: A Method of Allocating the Cost of Air Force Interdependent Support Activities to Mission Activities.* RM-1199-1. The RAND Corporation, Santa Monica, California, Revised February 1955. (DDC No. AD 85-487).

Presents a method for allocating costs of support activities to basic mission activities. It takes into account the interdependence of such activities, i.e., support of each other as well as of mission activities. The method of cost allocation is based on the use of an interactivity flow model. The problem of cost allocation is treated in two stages: (1) A simplified cost allocation problem involving three support and two mission activities is solved algebraically. (2) A numerical example of the same problem is introduced with the computational steps for solving it. A general case involving non-support activities with an algebraic solution is also presented.

M100.0460 Fisher, G.H. *Military Systems Cost Analysis (A Summary Lecture for the AFSC Cost Analysis Course).* RM-2975-PR. The RAND Corporation, Santa Monica, California, January 1962.

Contains a discussion of the concepts and principles of weapon system cost analysis. Cost analysis is described as the determination of the probable economic resource impact of future military systems. Five major aspects of cost analysis are (1) understanding the problem of context in which cost estimates are to be used, (2) assembling the basic data, (3) deriving cost estimating relationships, (4) using these relationships to develop estimates, and (5) presenting the results. Hardware and non-hardware system cost components, and the sensitivity of total system cost to variation in the specifications of these components, are considered. A list of cost elements for a missile system is also included.

M100.0480 Fisher, G.H. *Total Force Structure Cost Analysis.* RM-3070-PR. The RAND Corporation, Santa Monica, California. For Official Use Only, (DDC No. AD 292-751). Also published as Chapter II in J.P. Large (ed.), *Concepts and Procedures of Cost Analysis,* RM-3589-PR. The RAND Corporation, Santa Monica, California, June 1963, pp. II-1-II-14, For Official Use Only, (DDC No. AD 411-554).

Contains a summary description of total force structure cost analysis. Detailed costing procedures and techniques are not included. The purposes of the analysis are reviewed and the relationships between total force cost analysis and individual weapon or support systems are examined. An illustrative format shows the summary of total force structure cost estimates.

M100.0500 Fishman, George S., *Military and Economic Consequences of Alternative Spare Engine Policies.* RM-4475-PR. The RAND Corporation, Santa Monica, California, March 1965. (DDC No. AD 459-078).

A method is described for estimating spare engine requirements. Its advantage over the spare engine computation procedure currently employed in the Air Force derives from its explicit consideration of how a spare engine policy affects mission accomplishment and the economic account of these considerations and thus provides rather arbitrary insurance stocks. (Author)

M100.0520 Fox, P. *Decision-Making Under Uncertainty. Overshooting Effectiveness in Large Scale Military Systems.* Report No. W5271. MITRE Corporation, Bedford, Mass., May 1963. (DDC No. AD 409-470).

Theoretical discussion proposing that the minimum expected cost of developing a large scale military system under conditions of uncertainty is achieved by overshooting effectiveness goals. Implications of the theory in regard to the timing of planning and acquisition are explored and the relationship between the theory and policy is discussed.

M100.0540 Fox, Peter D. "A Theory of Cost-Effectiveness for Military Systems Analysis," *Operations Research,* Vol. 13, No. 2 (March-April 1965), 191-200.

This paper presents a theoretical basis for cost-effectiveness analysis. It is argued that, frequently, a range of

effectiveness or cost levels may be acceptable to whoever must ultimately decide which military system, if any, should be acquired. The function of the analyst is to present a schedule of alternatives and not to optimize in the sense that he recommends the selection of a particular alternative. The formulation of the schedule is discussed where the cost and effectiveness associated with each alternative are viewed as random variables. The paper concludes with some general observations relating to military system selection.

M100.0542 Gerngross, J.E. and Huddleston, F.J. "Analysis for Evaluation of System Performance," *IEE Int. Convention,* Vol. 13, Part 6 (1965), 40-8.

Method allows comparison of changes in various parameters in their effect on system performance; result is quick and easy derivation of equivalent trade-offs between any two or more parameters: command control communications system is chosen for illustration; objective of system is probability of transmitting successful message; analyses show that some parameters improve system performance and others degrade it; degradation may be acceptable or improvement not worth its cost when secondary objectives are analyzed; flow chart summary allows direct comparison between primary and secondary objectives of system as function of each parameter.

M100.0560 Glennan, Thomas K., Jr. *Methodological Problems in Evaluating the Effectiveness of Military Aircraft Development.* P-3357. The RAND Corporation, Santa Monica, California. Prepared for presentation at the National Meeting of the Operations Research Society of America (29th), May 1966. (DDC No. AD 634-243).

Development time does not seem to have an important influence on development cost, at least within the range of development times in the sample. State-of-the art advance, as determined by a group of experts, may have a negative relationship to development costs. This may be due to changes in the task goals which are not reflected in the variables. There is no evidence of productivity increases of the factors of development (if they have occurred) being taken out in the lowering of development costs. There is some evidence that the coordination of subcontracting efforts may raise development costs, however, these costs appear to be largely associated with tooling and/or production. (Author)

M100.0580 Glueck, Charles G., Hentz, Ronald F. and Rogin, Leo. *Sortie Availability on a Mission-by-Mission Basis.* NADC AW-6603. Naval Air Development Center, Johnsville, Penna., March 1966. (DDC No. AD 486-576).

The development of refined system and cost/effectiveness techniques for use in evaluation of naval aircraft systems has necessitated the simultaneous development of relevant models for measuring system availability. Such availability measures provide a vital input to system effectiveness determinations and are required to be increasingly detailed as effectiveness techniques become more refined. A detailed discussion of the capabilities and use of AVAIL, a general purpose sortie availability model being used in war gaming studies at NADC, is presented.

M100.0587 Goldman, A.S. *Introduction to the Economic Theory of System Development in Operational Support. TEMPO.* RM-62TMP-39. General Electric Company, Santa Barbara, Calif., 1 May 1962.

The prime purpose of this report is to present decision-making tools, derived from economic theory, to assist in the development of complex military systems. The emphasis is on the operational support aspects (reliability-maintainability-availability) of system design but the reader will also find that the philosophy applies to other areas, as well (e.g., performance trade offs). A secondary, but no less important, purpose is to present a primer of production economics for reference by engineers in various phases of product development.

M100.0600 Grodowitz, W. *Some Uses and Limitations of Cost Effectiveness Analysis in Military Decision-Making.* Office of the Director of Aerospace Programs. HQ USAF, Washington, D.C., October 1964.

M100.0620 Grosse, R.N. *Army Cost Model.* RM-3446-ASDC. The RAND Corporation, Santa Monica, Calif., December 1962.

Describes an Army cost model developed by the RAND Corporation for the Programming Office, Assistant Secretary of Defense (Comptroller). The model is used for rapid cost estimating of alternative forces for use in cost-effectiveness studies and for projecting approximate budget sizes. The model is structured to simulate Army processes in a simplified manner. Data needs and sources for developing the model inputs are described. An outline of the time scheduling for its development is included.

M100.0640 Grosse, Robert N. and Proschan, Arnold. "Military Cost Analysis," *American Economic Review.* Vol. LV, No. 2 (May 1965), 427-433. Also published by Research Analysis Corporation, McLean, Virginia, RAC-P-6, August 1965.

Describes how costs are related to military worth for purposes of defense planning. The features of military cost analysis are outlined and described. Such features include (1) total program costing, (2) cost categories, (3) timing of costs, (4) net costing, (5) developing relative costs, (6) recognition of uncertainties and (7) the use of estimating relationships. The introduction of cost analysis in the Department of Defense is discussed within the context of the new programming system. Current developments and the future needs of cost analysis are described.

M100.0660 Grosse, R.N. and Proschan, A. *Uses of Automated Force Cost Models.* RM-3608-ASDC. The RAND Corporation, Santa Monica, California, April 1963. (DDC No. AD 403-268).

An automated force cost model is described in this memorandum as a device for rapidly computing the resource requirements of a force having a specified composition, deployment, equipping and manning levels, and other characteristics affecting costs. The major uses of automated cost models are (1) for the planning of alternative force structures and employment and (2) for programming and budgeting. For planning purposes, cost models permit the rapid calculation of cost estimates for alternative force compositions under consideration for future time periods. Experience in the use of cost model for programming and budgeting is limited. The adaptation of cost models to the DOD program/budgeting system is described.

M100.0663 Harris, H.F., "Installations," in J.P. Large (ed.). *Concepts and Procedures of Cost Analysis.* RM-3589-PR. The RAND Corporation, Santa Monica, Calif., June 1963, p. XI-1-XI-8. (DDC No. AD 411-554).

This chapter describes procedures for estimating require-

ments and costs of installation facilities. Cost estimates for a missile base are presented as illustration, and a list of estimating relationships for the individual items of construction is included.

M100.0667 Hatry, Harry P. *Cost-Benefit Analysis as an Aid to System Selection.* General Electric Systems, Schenectady, New York, November 15, 1962.

A method of analyzing systems is presented as an aid in the selection of a system to perform some given mission. The method considers both the cost and effectiveness criteria jointly. The method is illustrated by the following missions: system to repair orbiting satellites; weather and reconnaissance satellites; tactical bombing aircraft and nuclear detection system.

M100.0680 Hatry, H.P. *Estimation of Military Support Activity Costs.* RM-60-TMP-49. General Electric Company, Santa Barbara, California, Technical Military Planning Operation, TEMPO, August 1960.

This report outlines a general procedure for estimating support costs of military forces. The steps are (1) the identification and categorization of various activities of the military service, (2) the determination of each support activity, (3) the derivation of numerical relationships between support and supported activities, and (4) the application of such relationships to force alternatives under consideration. It is assumed in the outlined steps that the magnitudes of support vary in linear fashion with the selected variables and that the relationships indicated by the year examined will apply substantially to future years.

M100.0700 Hatry, H.P. and Jackson, F.S. *Cost of Alternative Programs Philosophy and Characteristics.* SP-96. General Electric Company. Santa Barbara, Calif., Technical Military Planning Operation (TEMPO), July 1960.

Describes the development of a computational planning method for estimating costs of alternative military programs. The methodology is a computational device built on a series of mathematical and statistical techniques. Its purpose is to determine rapidly the impact of alternative decisions on requirements for resources in current and future time periods. Mathematical and statistical methods are examined for their application in estimating the economic impact of alternative program projections.

M100.0720 Herd, G.R. and Moxley, F.H., Jr. *Cost-Effectiveness Optimization (Summary, Conclusions and Recommendations).* AFSC-TR-65-4. Volume I. Air Force Systems Command. Washington, D.C., January 1965. (DDC No. AD 458-595).

M100.0740 Heymont, Irving. *The Threat Factor in Cost-Effectiveness Analyses.* RAC-TP-222. Research Analysis Corp., McLean, Va., June 1966. (DDC No. AD 484-201).

The threat factor is considered in cost-effectiveness analysis and similar military studies in order to provide a range of portrayals that influence the achievement of the objective. These portrayals permit testing the sensitivity of alternative courses of action to the threat assumptions. Standard threat course materials require modification in light of the specific analysis under study because of the response of the enemy to the friendly moves under study. The major threat parameters are time, the enemy, locale, type of warfare, political context, and technology. These parameters are variable uncertainties within themselves and interact with each other. The magnitude of these combined uncertainties can be reduced to a manageable number and range by carrying three threat estimates through the analysis: 'optimistic' and 'pessimistic', which bracket confidence of likelihood of occurring. (Author)

M100.0742 Heymont, I. *et al. Guide for Reviewers of Studies Containing Cost-Effectiveness Analysis.* Research Analysis Corporation, McLean, Va., 1965.

Presents a series of "key questions" as an aid in evaluating military cost-effectiveness analyses.

M100.0760 Henderson, Clark. *Analysis of NPES Systems: Cost-Effectiveness Summary.* DA-49-018-ENG-2953. Stanford Research Institute, Menlo Park, Calif., June 1966. (DDC No. AD 486-887).

The purposes of this research were to develop methodology for analyzing and evaluating the operational feasibility of the NPED concept, to conduct cost-effectiveness analyses of NPES systems employed in selected operational situations, and to provide data and assistance to the engineer strategic studies group for the preparation of preliminary estimates and evaluations of the NPED concept. This report briefly describes the methodology and summarizes the results of the project. The nuclear powered energy depot (NPED) concept envisions a system to supply energy to army forces in the field by using mobile nuclear reactors that move with the force rather than by transporting petroleum fuels from refineries to the force. The possibility of using mobile nuclear power has interested the Army for several years and has led to its sponsorship of a research program concerning the scientific and technical problems in this field and the items of equipment that might be used with nuclear power energy supply (NPES) systems. The NPED concept includes two broad approaches for the exploitation of nuclear power. One approach is the use of ammonia to replace motor gasoline and diesel fuel; the second is the storage of electrical energy in battery-like devices called regenerable electrochemical cells.

M100.0780 Hitch, C.J. *An Appreciation of Systems Analysis.* P-699. The RAND Corporation, Santa Monica, California. August 1955. (DDC No. AD 422-837). Also published in *Journal of the Operations Research Society of America,* Vol. 3, No. 4 (November 1955), 466-481.

Military systems analysis, an outgrowth of operations research of World War II, is described as a technique for examining military problems of broader context and longer range. The development of systems analysis has taken the following form: (1) the use of analysis to aid in force composition and development, as well as in operations decisions; (2) a great increase in the number of interdependent factors considered; (3) the explicit treatment of problems of uncertainty; (4) the explicit treatment of enemy reaction; (5) time phasing; and (6) a broader concept of objections and criteria.

M100.0785 Hitch, C.J. *Cost Effectiveness.* Military Operations Research Symposium, Washington, D.C., April 1964.

M100.0800 Hitch, C.J. "Cost Estimating in the Department of Defense," *Armed Forces Comptroller Magazine,* Vol. 10, No. 1 (March 1965) 3-6.

This article discusses the need and practice of cost estimating in DOD. The need for cost analysis is for: (1) system planners in selecting new systems for development, (2) financial managers in preparing budgets, (3) contract negotiations, (4) project managers in evaluating program changes and preventing overruns, (5) economic analysts in assessing the impact of procurement decisions on the economy. The problem of securing the necessary data is described. The objectives of the DOD Cost and Economic Information System are outlined as the collection, validation, storage and retrieval of cost and related data.

M100.0825 Hopkins, R.C. "A Systematic Procedure for System Development," *IRE Transactions on Engineering Management,* Vol. EM-8, No. 2 (June 1961), 77-86.

A technique is described for the development of system objectives, requirements, specifications, and conceptual design. It is derived from experience with a number of actual systems in the fields of air defense and airborne fire control. The need for precise knowledge of system functional objectives is stressed. A checklist relating to environmental requirements is presented. A seven-step process is described from functional objectives to model and test.

M100.0831 Howard, W.J. and Goldman, A.S. *Application of Some Economic Concepts to System Operational Availability. TEMPO.* RM-62TMP-7. General Electric Company, Santa Barbara, Calif., 1 June 1962.

Subject to performance requirements, systems designers and management are concerned with either (1) allocating a fixed budget between reliability and maintainability in order to maximize availability, or (2) attaining a required availability at minimum cost. By means of discussion and example, the problem of choosing among alternatives is investigated relative to achieving desired levels of systems availability.

M100.0840 Jones, M.V. *Bidder Cost Estimates as a Data Base Source for Advanced Systems Costing.* TM-3538. The MITRE Corp., Bedford, Mass., January 1963.

This paper proposes that bidder cost estimates received in the course of system source selection be included in the data base for costing advanced military systems. It describes the advantages of bidder cost estimates, suggests precautions in their use, and recommends standards for their effective utilization. The type of data that can be derived from bidder cost estimates is specified.

M100.0860 Jones, M.V. *Cost Factors as a Tool in Military System Cost Analysis.* TM-3172. The MITRE Corporation, Bedford, Massachusetts. November 1961.

This memorandum defines and describes cost factors, their advantages, and their limitations. A system is outlined for deriving, documenting, and using cost factors. Factors are statistically derived from average or general relationships in historical data, as modified by the judgment of the analyst. The cost factor can represent linear or nonlinear relationships and can be related to several variables. The basic advantage of using factors is their convenience. The proper use of factors as opposed to direct measurement is discussed. Documentation of the derivation of cost factors is important and examples of such documentation are included in appendices.

M100.0880 Jones, M.V. *How to Estimate the Investment Cost of Electronic Data Processing Equipment.* MTR-70. The MITRE Corp., Bedford, Mass., December 1965.

The purpose of this document is to provide practical guidance to analysts estimating the investment costs of the electronic data processing equipment for Air Force Command and Control systems. Several different methods for estimating Air Force major system items, and the conditions for their application, are discussed. It is also intended that the paper present a format for developing additional estimating methods. Sources of information for electronic data processing equipment are included. The use of analogies, CERs, catalog prices and expert advice are discussed as approaches to estimating costs.

M100.0900 Jones, M.V. *System Cost Analysis: A Management Tool for Decision-Making.* TM-04063. The MITRE Corp., Bedford, Mass., November 1965. (DDC No. AD 624-893).

A generalized, integrated conceptual approach is presented for the major steps involved in estimating the costs of a military system. The common methodological problems and tasks involved in costing all military systems are identified. The entire process of costing a system is discussed and the methodological relationships of each sequential step to preceding and subsequent steps are shown. Fundamental principles are stressed as opposed to a catalog of resource costs and estimating relationships or a case book detailing the specific procedures used to cost particular systems in the past. The approach is task oriented in the sense that discussion centers around such highly practical questions as the following: what an analyst should learn about the client's intended application of the estimate and about the details of the system he is to cost before he begins the costing task itself; the criteria an analyst can use to help him realize the greatest benefit in a limited time; the types of activities and resources he should cost and in what detail; the types of data he should seek as a basis to cost such activities and resources, and the sources from which he should try to collect these data; how he should proceed to evaluate and synthesize his data inputs to arrive at his system cost estimate; how he should present the details of his findings to be most meaningful to his client. (Author)

M100.0911 Kinch, R.E. "Human Factors in Measurement of Total System Effectiveness," *Journal of Industrial Engineers,* Vol. 14, No. 6 (November-December 1963), 297-9.

Utilization of engineer's tools and techniques to other stages in total system evaluation of defense weapons instead of only to man-machine functional operations, is proposed; it is pointed out that undesirable human behavior at any point in this total system must be considered not only in terms of immediate cost and delay, but on performance of equipment; research program to develop human error-proof reporting procedure.

M100.0920 Kissel, J. *Advanced Systems Cost and Cost-Effectiveness.* USAF, Air Force Systems Command. Aeronautical Systems Division. Wright-Patterson Air Force Base, Ohio. June 7, 1962.

This paper is concerned with the importance of force structure analysis and cost-effectiveness analysis to potential weapon systems. The capabilities of the Directorate of Advanced Systems Planning, ASD, for the performance of this function are described. Basic definitions of the terms and concepts of systems analysis are included.

M100.0940 Knorr, Klaus. *On the Cost-Effectiveness Approach to Military R & D: A Critique.* P-3390.

The RAND Corporation, Santa Monica, California, June 1966.

Describes the more serious limitations and hazards of the cost-effectiveness approach to choices in the military. Some aspects of the management problem raised by these limitations are discussed with special reference to R & D decisions. Limitations are described as incommensurability among sets of costs and benefits, imperfect information, and the emphasis placed on money costs. It is recommended that qualitative elements receive as much attention as the quantitative aspects of an analysis. The limitations of cost-effectiveness analysis are described as being greater for R & D choices because uncertainties are greater and more numerous.

M100.0951 Markel, Gene A. *Toward a General Methodology for Systems Evaluation.* HRB-Singer, Inc., State College, Pennsylvania, July 1965.

The paper attempts to establish a generalized approach to systems evaluation. A fundamental perspective on systems evaluation is formulated by applying the rudimentary principles of evaluation to the system concept. Systems may be evaluated on the basis of their structural, operational or performance characteristics. A modular approach is recommended as most valid and practical for general systems evaluation. The modular concept is employed to establish requirements for the evaluation of intelligence systems and some applicable modeling concepts are described. An annotated bibliography of some literature related to systems evaluation is included as an appendix.

M100.0960 Martino, Joseph P. "Systems Analysis and Counterinsurgency," *Air University Review,* Vol. 17, (September-October 1966), 23-33.

Develops a model to illustrate the possible applications of systems analysis to problems of counterinsurgency.

M100.0980 Matheson, John D. *An Application of Game Theory to an Offense-Defense Resource Allocation Problem.* Analytic Services, Inc., Falls Church, Va., October, 1965. (DDC No. AD 478-569).

This report presents a two-sided resource allocation game in which one player allocates his resources between two offensive weapon systems to maximize target destruction. The game is continuous in the sense that all variables are assumed to be continuous, and static in the sense that time is not a variable. Explicit solutions are obtained in terms of the parameters of the problem.

M100.1000 McKean, Roland N. "Cost-Benefit Analysis and British Defense Expenditures," *Public Expenditures: Appraisal and Control,* ed. Alan T. Peacock and D.J. Robertson. Edinburgh, Oliver and Boyd, 1963, p. 17-35.

M100.1020 Meltsner, A.J. and Swaine, H.R. *Navy Cost Model.* RM-3660-ASDC. The RAND Corporation, Santa Monica, California, June 1963. (DDC No. AD-407-323).

The purpose of this briefing is to present a description of the preliminary work on a Navy cost model. This cost model is to be used for rapid cost estimating of alternative forces for use in cost-effectiveness studies and for projecting approximate budget levels. In the initial development of this model, a determination was made as to the kinds of output the model should have. In general, these outputs are to be compatible with those of the OSD programming system. The model is structured to simulate Navy processes in a simplified manner, the structure being based on a study of the organization, policies, and procedures of the Navy. Finally, highly summarized statements of research projects are presented for the over-all model development work.

M100.1040 Noah, J.W. *Concepts and Techniques for Summarizing Defense System Costs.* Center for Naval Analyses, Washington, D.C. Systems Evaluation Group RC-1, September 1965.

Discusses methods for summarizing and presenting system costs. Five methods are outlined and described as follows: (1) the five-year system cost, which is defined as the summation of R & D, investment and five years of operating the system, (2) period outlay, which is described as annually phased costs covering a specified period, (3) net cost, which considers the remaining values of system cost, (4) present cost, which is described as costs in terms of their present values, and (5) annual cost, which constitutes present costs on an annual basis. Computing methods for the different summations are included together with illustrations and tables.

M100.1060 Noah, J.W. *Defense Systems Cost Analysis,* Center for Naval Analysis, Cost Analysis Group, Washington, D.C., April 1965.

Contains a general discussion of the place of cost analysis in military planning. Uncertainties and biases in estimating costs are discussed, together with their resulting effects on the accuracy of the cost estimates. The causes of uncertainty and bias are examined. A number of the more fundamental methods of estimating costs are discussed. The DOD programming system is considered in its relationship to cost analysis, and the history of the development of systems cost analysis is related.

M100.1080 Novick, D. *System and Total Force Cost Analysis.* RM-2795-PR. The RAND Corporation, Santa Monica, Calif., April 1961. (DDC No. AD 257-269).

Describes the aims, concepts, and methods of military cost analysis as developed by RAND's Cost Analysis Department. Included are descriptions of methods for estimating the costs of individual systems and total forces. The elements of cost for military systems are outlined and described for each of the cost categories: R & D, investment, and operating. The concepts and elements of total force structure cost analysis are discussed. Examples of the use of cost sensitivity analysis are given, as well as EDP output formats. A bibliography is included.

M100.1100 Peterson, J.W., Nelson, H.W. and Paulson, R.M. *The Costs and Benefits of Responsible Support Operations.* The RAND Corp., Santa Monica, Calif., October 1962. (DDC No. AD 293-431).

How responsive the Air Force system should be in translating changing support needs into workloads in back-up areas of support.

M100.1109 Petruschell, R.L. *The Derivation and Use of Estimating Relationships.* RM-3215-PR. The RAND Corporation, Santa Monica, Calif., June 1962. (DDC No. AD 276-673).

Describes various estimating techniques and procedures developed by the Cost Analysis Department in the course of its research on Air Force systems. The use of estimating

relationships in costing is discussed and the approach to their development is described. Illustrations show their application in cost analysis. The skills needed by the cost analyst to develop estimating relationships are defined, and the application of statistical procedures, including scatter diagrams, correlation analysis, and regression analysis, is described.

M100.1112 Petruschell, R.L. and Chester, J.M. *Total System Cost Analysis -- Part I.* RM-3069-PR. The RAND Corporation, Santa Monica, Calif., January 1963. (DDC No. AD 295-149).

Contains a discussion of the fundamentals of Air Force systems cost analysis. Descriptions are included of weapon systems, support systems and the administrative structure. The cost categories of R & D, investments, and operation are discussed, along with their expenditure patterns over time. The cost elements of Air Force systems are outlined and detailed descriptions are given for estimating personnel and primary equipment requirements. The use of cost-quantity curves is explained and examples are included.

M100.1120 Quade, E.S. *The Limitations of a Cost-Effectiveness Approach to Military Decision-Making.* P-2798. The RAND Corporation, Santa Monica, California, September 1963.

A defense of the value of cost-effectiveness analysis as a basis for decision-making against charges of its being oversold. The author appreciates its limitations, but points out that they are less drastic than the faults of possible alternatives.

M100.1160 Quade, E.S. *Pitfalls in Military Systems Analysis.* P-2676. The RAND Corp., Santa Monica, California, November 1962.

A discourse on the kinds of errors that are found in systems analysis studies. Systems analysis is designed to suggest a course of action by systematically examining the costs, effectiveness, and risks of alternative policies or strategies, and by designing additional ones if those examined are found wanting. The errors mentioned are divided into two classes: simple mistakes or blunders, which are largely due to ignorance, stupidity, or carelessness; and fallacies, which represent a false idea or an error in logic.

M100.1220 Sobin, B. *Cost-Effectiveness Analysis.* Institute for Defense Analyses, Weapons System Evaluation Group (WSEG), Arlington, Virginia, November 1962.

This paper describes the role, nature, and difficulties of cost effectiveness analysis. The criterion is the satisfaction of military capability requirements at least cost. Under consideration for the analysis are (1) the technological relationships among weapon systems development and deployment, costs, and time; (2) effectiveness through time of possible systems; and (3) uncertainties. The obstacles to objective optimization are described as (a) contradictory objectives, (b) indefinite time horizons, and (c) inaccurate or missing data.

M100.1240 Steiner, R.G. *Military Transport System Costing--Initial Investment and Annual Operations and Maintenance.* The Boeing Airplane Company, Seattle, Washington. D6-9600 as revised, September 1963.

Describes a methodology for developing program costs of air transport systems. Program costs are developed as part of presentations to the military and also in order to evaluate new aircraft design. The CX-4 system, with illustrative values, is used as an example in the development of a program cost. Cost element lists and applicable estimating relationships are outlined and defined. Methods for developing system personnel requirements are also presented.

M100.1260 Stone, Donald R. *Discounting in Military Cost-Effectiveness Studies.* Master's thesis, Naval Postgraduate School. Monterey, California, 1965. (DDC No. AD 475-334).

Discounting is a means of assigning different weights to cost expected to be incurred in different future time periods. Such costs are a vital element of cost-effectiveness studies, which under present Department of Defense policy provide the primary basis for military procurement and force structure decision-making. The discounting process is reviewed, and an attempt is made to identify qualitatively the factors which should determine the discount rate to be used in Department of Defense cost-effectiveness studies. These factors are separated into two groups: those which apply to cost-effectiveness studies of all types of weapons systems, and those which depend upon the type of system being considered. Finally, the manner of presenting the results of the discounting process to the decision-maker is discussed.

M100.1300 Surmeier, John J. *An Individual System/Organization Cost Model.* Vol. I, *Concept and Application.* Vol. II, *Computer Program Design and Operation.* RAC-TP-182. Research Analysis Corp., McLean, Virginia, January 1966.

These two volumes document the Individual System/Organization Cost Model (ISOC) and its application. The ISOC model is a computer program developed to estimate relative costs for large numbers of alternative military systems. The model has been used at RAC in a variety of costing applications including (1) Army aircraft inventory costing, (2) light observation helicopter cost-effectiveness analysis, (3) estimating costs of aircraft and sensor configurations, and (4) computing costs of multi-equipment organizations. The emphasis in this document is on a basic description of the ISOC model rather than on cost-estimating methodology, derivation of inputs for the model, or analysis of the costs computed.

M100.1320 U.S. Department of Defense. *Material Readiness Through Integrated Logistic Support.* Washington, D.C., AD HOC Committee, Final Report on Volume 7, May 1965. (DDC No. AD 471-562).

Efforts are reported to develop a knowledge of current and proposed cost-effectiveness and similar scientific management techniques and evaluate their suitability for conducting trade-offs among the elements of logistics and between the plan for use and the plan for support.

M100.1340 U.S. Department of the Air Force, Directorate of Studies and Analysis. *Defense Evaluation Through Effectiveness and Cost Techniques (Detect). Volume I. Users and Operators Guide,* 1966. (DDC No. AD-489-546L).

Detect is an automated expected value model which evaluates combinations of defensive forces against a specified offensive threat in terms of effectiveness and cost-effectiveness over a fifteen year period. The model games an offensive threat of sea launched ballistic missiles (SLBMS), inter-continental ballistic missiles (ICBMS), and supersonic and subsonic bombers against various defensive combinations.

Defense forces can be combinations of manned and

unmanned interceptors, terminal bomber defenses, and long range, mid range, and terminal antiballistic missile (ABM) defenses. The offense attempts to achieve a definite level of damage against a specified target complex, by committing enough weapons to achieve a probability of killing each target equal to a desired damage level. The effectiveness of the various combinations of defenses is then measured in terms of targets saved for the amount of money spent for defense.

M100.1360 U.S. Air Force Systems Command. WSEIC, *Cost-Effectiveness Optimization (Technical Supplement).* AFSC-TR-65-4. Final Report of Task Group IV, Vol. III. Andrews Air Force Base, Maryland, January 1965. (DDC No. AD 458-586).

"A discussion of optimization which amplifies the material in Volume II, Section IV is presented. Optimization principles, criteria and check-lists, as well as a summary of various applicable techniques is included. A series of six examples are described covering a number of critical aspects of cost-effectiveness analysis in considerable detail. Treated in the examples are: (1) Optimization of effectiveness based on reliability, maintainability, performance, and cost; (2) Allocation of reliability requirements among subsystems; (3) Payload allocation among three subsystems based on a fixed weight constraint; (4) Determination of best checkout routine for a limited prelaunch test; (5) Optimization of availability for a complex system; and (6) Trade-off study between site hardening and dispersal for a missile system."

M100.1380 U.S. Air Force Systems Command. *WSEIAC, Cost-Effectiveness Optimization (Summary, Conclusions and Recommendations.)* AFSC-TR-65-4. Final Report of Task Group IV, Volume I. Andrews Air Force Base, Maryland, January 1965.

The underlying principles associated with cost-effectiveness analysis are discussed. The rationale, purpose, methodology required, and nature of the results that can be obtained by means of the analysis are presented in summary form. Illustrations of the type of input data required and the logic associated with its application are provided. The summary constitutes an overview of the more detailed task analysis and supplementary technical material presented in Volumes II and III. Included are the conclusions and recommendations as set forth in Volume II.

M100.1400 U.S. Air Force Systems Command. *Cost Estimating Procedures.* AFSCL-173-1. The RAND Corporation, Santa Monica, Calif., October 1965.

Contains procedures for applying the basic principles of cost estimating in the Air Force Systems Command. The preparation of the total system cost estimate is described, with emphasis placed on the systems acquisition costs. The procedures described serve as a guide for cost-effectiveness studies, program establishment, budget justification, and program reviews. Procedures are also included for the documentation and presentation of estimates to their users. A uniform program work breakdown structure is prescribed as a basis for program documentation, budget justification, contract work statements and technical specifications. The various steps for developing an estimate are discussed, including (1) the definition of the problem, (2) the evaluation of historical data, (3) developing and applying cost-estimating relationships, (4) selecting costing methodology, (5) time-phasing estimates, (6) study documentation, and (7) the review and evaluation of estimates.

M100.1420 U.S. Air Force Systems Command. *WSEIAC, Requirements Methodology.* AFSC-TR-65-1. Final Report of Task Group I. Andrews Air Force Base, Maryland, January 1965. (DDC No. AD 458-453).

The objective of Task Group I was 'To review present procedures being used to establish system effectiveness requirements and recommend a method for arriving at requirements that are mission responsive.' Applicable documents were examined, including Department of Defense Directives and Instructions, Air Force Regulations, Manuals, Specifications, Office Instructions, etc., that might be used to establish effectiveness requirements. Detailed examination of the Specific Operation Requirement (SOR) and the companion Directorate Office Instruction (DOI) 11-7 resulted in the preparation of a proposed Air Force Manual (Appendix I). This document provides checklists, guidelines, and procedures for SOR preparation that include the significant elements of system effectiveness. A proposed Air Force Regulation (Appendix II) was developed to formalize a program of effectiveness evaluation and prediction for the system life cycle. Policy, concepts, and major command responsibilities are developed. Additional conclusions and recommendations are submitted relative to the effectiveness requirements that constitute necessary steps to development of an Air Force wide system effectiveness management program.

M100.1440 U.S. Air Force Systems Command, Weapons System Effectiveness Industry Advisory Committee. *Cost- Effectiveness Optimization.* Final Report of Task Group IV. Washington, D.C., 1965.

Contents – Vol. 1: Summary conclusions and recommendations. Vol. 2: Tasks and analysis methodology. Vol. 3: Technical supplement.

M100.1460 U.S. Department of the Army Headquarters. AGAM-P(M). *Systems Analysis and Cost-Effectiveness.* Washington, D.C., April 1964.

M100.1480 U.S. Department of the Army. Adjutant General, Department of the Army. *Systems Analysis and Cost-Effectiveness Parts I-VI.* Washington, D.C., April 1964.

Systems analysis is a systematic quantitative approach to the complex military-economic problems encountered in the defense program. The systems analysis-cost effectiveness technique is not a cure-all, nor is it an automatic decision-maker. It is limited by the quality and subjectiveness of the measurable factors put into each alternative. An increased Army systems analysis effort can assist in attaining the best possible solution to Army problems and in proving the justification of related Army programs. Even if one disagrees in principle with some aspects of analysis or cost effectiveness comparisons, still an understanding is necessary of these widely-used principles and techniques. The contents of this letter are as follows: (1) Systems analysis as a part of the total management process; (2) Systems analysis – an informal summary; (3) Some thoughts on cost effectiveness from the Army viewpoint; (4) An example of a cost effectiveness analysis – analyst's thoughts; (5) Summary of a recent military operations research symposium; and (6) selected articles on systems analysis and cost effectiveness.

M100.1489 U.S. Department of Defense, Office of the Director of Defense Research and Engineering. *Survey of Studies and Computer Programming Efforts for Reliability, Maintainability, System Effectiveness.* Washington, D.C., September 1965. (DDC No. AD 622-676).

Survey of efforts under way or recently completed for computer programming or techniques that are adaptable to computer operations in the areas of system analysis for reliability, maintainability, availability, system effectiveness, cost-effectiveness, system simulation, circuit analysis, and failure mode and effects analysis.

M100.1500 U.S. Army Missile Command, Directorate of Procurement and Production, Research and Planning Section. *ACE, Automated Cost Estimates.* Huntsville, Ala., Redstone Arsenal, June 1963.

Describes a procedure for forecasting research and development costs, engineering service requirements and contractors' direct man-hour requirements. The paper consists of a series of tables, sets of estimating equations, flow diagrams and examples of computer outputs. Mathematical relationships, both linear and logarithmic, are presented relating time, labor, and cost. Schematic diagrams are included to describe data processing in the model.

M100.1540 Rohe, William D., Jr., "Engineering Integration in System Design," *Systems Effectiveness,* U.S. Department of the Navy, Office of Naval Material, Systems Effectiveness Branch, Washington, D.C., 1965.

The main purpose of this pamphlet is to provide to personnel of the Naval Material Support Establishment (NMSE) a collection of papers in a single volume which reflect the attitude and philosophy of the Chief of Naval Material towards various aspects of systems effectiveness. It also provides a discussion of the planning, design, and cost considerations in system development as well as some techniques now being utilized in the NMSE in order to realize the development of effective systems.

Contents: "Future Navy Weapons and Support Systems" (excerpt), by W.A. Schoech; "Analytical Techniques in System Design" (excerpt), by Leroy Rosen; "Reliability and Maintainability Considerations in Systems Design," by Paul Giordano; "Engineering Integration in System Design," by William D. Rohe, Jr.; "Planning Integration in System Design," by Gordon H. Jayne; "Cost Factors in System Design," by John W. Stone; "Man Parameters in System Support," by Keith N. Sargent; "The Key to Development Pay-Off," by E.A. Ruckner; "System Effectiveness Assurance Management," by Leslie W. Ball; "System Effectiveness–A Tool for Appraisal," by Keith N. Sargent; and "Systems Effectiveness–Navy," by Keith N. Sargent.

M100.1560 Van Tijn, D.E. *Cost Studies.* Arinc Research Corp., Washington, D.C. January 1962. (DDC No. AD 272-049).

A procedure for allocating Air Force base-level labor has been established and validated. This procedure forms the first step in providing a cost for failures (unreliability) and maintenance (lack of maintainability). Such costs are needed to trade off these equipment characteristics against initial cost and system effectiveness. In addition, the procedure furnishes an insight into the organizational cost of base level maintenance. Hence, it will furnish management tools to aid in the control of base maintenance organizations.

M100.1580 Visco, Eugene P. *A Beginning to Cost-Effectiveness Analysis.* Research Analysis Corp., McLean, Virginia, August 1963. (DDC No. AD 422-374).

This short paper describes a method of cost-effectiveness analysis developed to evaluate specific items of Army equipment in mathematical terms, as part of the larger problem of optimum allocation of resources. The medium (now 'main') battle tank was selected as the leading item on a list of Army equipment chosen for 'criticality in combat'. A Linear programming model for the Univac Scientific 1103A computer was set up to solve the problems of maximum combat effectiveness subject to dollar constraints and minimum cost subject to maintaining selected levels of combat effectiveness. Comparative combat effectiveness of U.S. and enemy forces was considered to be the product of ratios of rates of fire, probabilities of hit, and probabilities of kill, given hit. Later, weighting procedures allowed consideration of other factors. The area that gave the greatest difficulty, plus the application of a simplified programming model, qualifies the study's product as illustrative rather than factual.

M100.1593 Widrewits, Julius. *Concepts Relative to System Effectiveness.* Rome Air Development Center, Griffiths Air Force Base, New York, June 1964.

This memorandum presents a deflation of and mathematical model for measurement of system effectiveness. Improvements over existing deflations of systems effectiveness are incorporated in the model.

M100.1600 Waks, N. *Criteria for Cost Categorization.* TM-3050. The MITRE Corporation, Bedford, Massachusetts. June 1961.

This paper sets out criteria for classifying cost data into categories and elements for cost analysis in USAF electronic systems. Cost categories are described as the initial classification of total system costs, and cost elements are the detailed constituents of a cost category. This classification of costs into categories and elements is made to provide the means of identifying and stratifying the different types of cost for purposes of developing total system costs.

M100.1620 Yates, E.H. *Description of Cost Elements.* IMR-55. Defense Research Corp., Santa Barbara, Calif., February 1964.

Describes the cost elements that are included in DRC system cost analyses. The elements apply primarily to ICBM and ABM systems. A typical cost element list is included, grouping elements by R & D, investment and operating costs. A discussion is included for each element to define the costs covered by the element.

Weapons Systems

M110.0000 Odom, Charles T. and Sebastiani, Lambert J. *A Method of Considering Attrition Rate in Cost-Effectiveness Studies.* Ballistic Research Labs., Aberdeen Proving Ground, Maryland, September 1964. (DDC No. AD 453-841).

This report presents a method of considering attrition rate in cost-effectiveness studies. The method is developed and illustrated by its application to a typical situation in order to show the effect of attrition rate on missile and launcher requirements. The total number of launchers required to defeat a threat is expressed as a function of length of battle and attrition rate. The total number of missiles required to defeat a threat is expressed as a function of attrition rate. Total costs then can be determined for each weapons system reflecting the added cost of attrition.

M110.0100 American Power Jet Co. *Cost and Effectiveness Evaluation of the Floating Aircraft Maintenance Facility.* Final Report. Ridgefield, N.J., September 1966. (DDC No. AD 803-416).

This report presents the results of a cost and effectiveness study of a floating aircraft maintenance facility and a comparable land-based facility. It covers both investment and operating costs, system adequacy, impact on pipeline and pipeline operations, elimination of unnecessary aviation material returns to conus, operational factors, bonus gains, and an analysis of comparable land-based facilities.

M110.0120 Berman, E. *The Choice Among Systems in a Hostile Environment.* The MITRE Corp., Bedford, Mass., November 1961.

The problem of choosing among systems for the development of procurement of weapons is considered with the recognition that the enemy may respond with development or procurement decisions which are optimal from his point of view. A general solution and a partial solution for resource allocation in a single mission area and between two mission areas are presented.

M110.0140 Berman, E., Jannsen, T., and Glazer, H. *WASPACS Integration Model.* W-5645. The Mitre Corporation, Bedford, Massachusetts, December 1962.

Describes the Weapon System Planning and Control System which has been designed to measure the cost of modifying Air Force programs. Models for reprogramming USAF subsystems are integrated in the force structure model. This report is concerned with the first portion of the integration model, the development and production model. Definitions and notation are given in section 2, the data requirements in section 3, major contractor scheduling and costing subroutines in section 4, and section 5 contains a narrative and flowchart of the integration scheduling procedure and a description of the integration cost allocation procedure.

M110.0160 Boren, H.E., Jr. *Individual Weapon System Computer Cost Model.* RM-4165-PR. The RAND Corporation, Santa Monica, Calif., July 1964. (DDC No. AD 603-005).

This memorandum describes the operation of one computerized weapon system cost model used by the RAND Cost Analysis Department to determine resource requirements for individual weapon systems that consist of either aircraft, aircraft and air-to-surface missiles (ASM's), or strategic missiles (for personnel requirements only). Included is a general description of the model with particular emphasis on the personnel subroutine, which can handle eight specific types of weapon systems of the Strategic Air Command, the Air Defense Command, the Tactical Air Command, and the Military Air Transport Service, and extrapolate from these eight weapon systems 72 varying weapon system mixes and basing situations. The discussion is oriented toward describing the actual operation of the model rather than the underlying reasons for the methodology used.

M110.0180 Bostick, L., Earner, G., Gartner, R., Morgan, J. and Wilson, L. *Cost and Effects, Models and Data.* Volume 1. Bunker-Ramo Corp., Fort Huachuca, Arizona, March 1966. (DDC No. AD 484-054).

Five alternate systems were analyzed for the tactical fire direction system.

M110.0191 Brooks, Samuel H. *Reliability Cost/Effectiveness: A Pilot Study.* Final Report. Aerospace Corporation, San Bernardino, California, June 1964. (DDC No. AD 451-906L).

A mathematical model is developed and explored to examine the overall relationship between effectiveness–in terms of reliability, availability, and maintainability–and the costs to be allocated and apportioned among the reliability efforts. This model leads to an estimate of how much should be spent on reliability during design and development of a missile system, and how much should be spent in ensuring the reliability and availability for each individual missile during its operational life. A computer program was developed and parameter studies along these lines were initiated. Requisite optimization and information methods are discussed. Preliminary indications are that cost/effectiveness modeling is feasible and leads to methods of program control. Further studies to expand these results are recommended.

M110.0200 Carter, R.D. *A Survey of Techniques for Improving Cost Estimates of Future Weapon Systems.* Analytical Services, Inc., Falls Church, Va. March 1965.

Examines the causes of error in costing weapon systems and evaluates techniques to improve such estimates. The causes of error are categorized as technological uncertainty, requirements uncertainty, and cost uncertainty. Various techniques that have been developed in the past for dealing with uncertainty are discussed and evaluated. These techniques include cost-estimating relationships, adjustment factors, subjective probability distributions, and cost-sensitivity analysis.

M110.0220 Clapp, R.E. and Boren, H.E., Jr. *MISCOM: An Individual Missile Weapon System Computer Cost Model.* RM-5142-PR. The RAND Corp., Santa Monica, Calif., October 1966.

The model is used to determine the resource requirements of missile systems. It is the first step in a further development of such a cost model and discusses only personnel, RDT & E, initial investment, and recurring costs. The types of resources are discussed, together with the computer program, its operation, hardware procurement, input procedures, and output formats.

M110.0240 Clegg, D. *Procedures for Development of A Weapon System Cost Methodology for Navy Weapons.* General Electric Company, Technical Military Planning Operation. Santa Barbara, Calif., May 1959.

An introduction to weapon systems cost analysis for naval systems, systems costing being considered as a technique for military planning. Procedures are presented for developing a methodology suited to Navy systems costing. Data requirements are described in terms of existing data and the need for additional data, such as cost factors. The development of cost factors and the choice of variables are discussed. Sources for cost data and automatic compilation methods are described. Appendices present a description of accounts, the appropriation structure, and the series of expenditure accounts.

M110.0260 Cochran, D.W. and Eliel, L.F. *The Costing of Weapon System Equipment Logistics.* Aerospace Corporation, San Bernardino, California, December 1961.

Describes the role and costs of logistics for military systems. Maintenance costs are described as functions of the maintenance echelon, the waiting lines, failure rates, and component costs. The maintenance system is described and functional relationships of spares allowances to the failure rate of missiles are derived.

M110.0300 Curry, E.E. *An Approach to Estimating Advanced Systems Operating Costs.* Air Force Systems Command, Aeronautical Systems Division. Wright-Patterson, Ohio, October 1962.

Describes a method for deriving annual operating costs for manned aircraft systems and associated airborne missiles. These costs are defined as primary and support operating costs. Primary operating costs include the items necessary to support the major equipment regardless of the operational concept, and support costs include all other items. The cost elements within these groupings are outlined and described. Primary operating costs include flight crew pay and allowances, aircraft POL, and aircraft maintenance costs. Support operating costs include facilities maintenance, special services, annual training, and miscellaneous expenses. A sample format is included.

M110.0320 Devlin, W.G. *Tactical Fighter Weapon System Costing – Initial Investment and Annual Operation and Maintenance.* Boeing Airplane Company, Seattle, Washington, March 1964.

Describes a method for developing program costs of tactical fighter systems. Program costs are developed as part of presentations to the military and also for the purpose of evaluating new aircraft design. Cost element lists and corresponding estimating equations are included for an example with illustrative values. Methods for developing personnel requirements are also described.

M110.0340 Dunlap, D.S. and Pettress, J. Mae. *A Parametric Study of the Delivery under Risk Problems as it Applies to Interdiction Cost Effectiveness.* Systems Engineering Group, Research and Technology Division. Wright-Patterson Air Force Base, Ohio, April 1964. (DDC No. AD 439-499).

Two aircraft are compared with regard to pounds deliverable per dollar spent and vulnerability.

M110.0360 Electronic Industries Association, Systems Requirements Committee. *Symposium on the Methodology of Weapons Systems Decision.* San Francisco, California, 1962.

M110.0380 Enke, Stephen. "Using Costs to Select Weapons," *American Economic Review,* Volume LV, No. 2 (May 1965), 416-426.

Describes the evolution, accomplishments and limitations in the application of economics to defense planning. This application has come to be known in the military establishment as cost-effectiveness analysis. The origins of economic analysis for defense planning are traced back to the early RAND Corporation strategic studies of the late 1940's. Cost-effectiveness analysis was introduced in the Pentagon in 1961 with the new programming system. Problems in the use of the cost-effectiveness approach are discussed, such as the lack of system comparability and the lack of measurable output. Further refinements are indicated in the areas of discounting, salvage values, and enemy reactions to system decisions.

M110.0385 Fields, D.S., Hatry, H.P., and Peterson, H.H. *Measuring the Reliability in Cost Analyses (Metrical).* TEMPO RM-62-TMP-82. General Electric Company, Santa Barbara, Calif., January 1963.

This report describes a technique for qualifying the uncertainty of cost estimates. The techniques involve cost analysts providing ranges of values for cost equation parameters whose value cannot be predicted with high certainty. Based on the particular form of the probability distribution, expected values and variances are computed from the estimates. By combining the estimates, an expected value and variance can be estimated for the total cost. An application of the method is presented using a study of two torpedo systems.

M110.0390 Fredric, B.C. *Cost Estimating and the Scientific Method.* IMR-232. Research Corporation, Santa Barbara, Calif., March 1965.

The purpose of this paper is to demonstrate that the current approaches to weapon system cost estimating are generally in agreement with the scientific method. The major steps of the scientific method are defined and explored as to both their formal content and their bearing on the cost-estimating problem. Conclusions are presented concerning differences between the formalized discipline and practical implementation. General recommendations are included for future cost estimating.

M110.0400 Fisher, G.H. *Generalized Depot Maintenance Cost Estimation Relationships for Bomber and Fighter Aircraft.* RM-3064-PR. The RAND Corporation, Santa Monica, California, May 1962. (DDC No. AD 27615).

Fighter and bomber depot maintenance costs are examined in relation to various features of the aircraft. Statistical regression analyses are used to determine the variable or set of variables that best explain variations in aircraft depot maintenance costs. The results indicate that simple relationships between maintenance costs and aircraft level-off costs can serve as well as the other aircraft features studied. The estimating relationships derived are presented together with accompanying standard errors of estimate, prediction intervals, and other statistical measures.

M110.0420 Harrell, Cleon and Olsen, Bernard. *A Guide for Cost-Effectiveness Studies in the Tactical Air Command.* Tactical Air Command, Langley AFB, Virginia, TAC OA WP 113, July 1964. (DDC No. AD 444-251).

Contents: Introduction; National Output Considerations in Cost-Effectiveness Analysis; Illustrative Applications of Cost-Effectiveness Analysis to three hypothetical aircraft systems; Choosing between two weapon systems development programs; and A Checklist of common errors in Cost-Effectiveness Analyses.

M110.0440 Hatry, H.P. *Techniques for Estimating Future Force Compositions for Aircraft Weapon Systems.* General Electric Company, Technical Military Planning Operation (TEMPO). RM-59-TMP-39. Santa Barbara, California, August 1959.

This paper describes mathematical techniques for estimating future aircraft inventories from procurement schedules, and for developing aircraft procurement schedules to meet specified future inventory positions. The first section presents equations which assume a pre-established attrition rate for each year. Attrition rate as a function of flying hours is then introduced. Three approaches are presented for estimating future inventory

positions from procurement schedules. Though computationally different, they yield similar results. Equations are included for estimating both numbers of aircraft and numbers of aircraft squadrons.

M110.0460 Hayes, Dwayne F. and Freeman, Raymond C., Jr. *Airborne Missile Range Station. Comparative Cost Study.* Boeing Company, Renton, Washington, July 1960. (DDC No. AD 261-323).

M110.0480 Herd, G.R. and Moxley, F.H., Jr. *Weapon System Effectiveness Industry Advisory Committee (WEIAC). Volume II. Cost-Effectiveness Optimization (Tasks and Analysis Methodology).* AFSC-TR-65-4 Volume 2. Air Force Systems Command, Washington, D.C., January 1965, (DDC No. AD 462-398).

This report discusses the philosophy of cost-effectiveness and techniques for trade-off and optimization studies. It lists and discusses twelve tasks necessary to perform a cost-effectiveness analysis. A methodology is outlined for identifying and standardizing cost and effectiveness factors. Descriptive analytical models for cost-effectiveness are provided, including discussion of their sensitivity and validity. One section defines and discusses risk and uncertainty and their effect on the decision-making process. Included is an extensive bibliography on cost-effectiveness. A technique is illustrated for cost-effectiveness optimization in the definition phase when there is a relative dearth of data, program objectives are fixed, and system effectiveness is unconstrained. (Author)

M110.0500 Herd, G.R. and Moxley, F.H., Jr. Weapon System Effectiveness Industry Advisory Committee (WSEIAC). *Cost-Effectiveness Optimization.* AFSC-TR-65-4 Volume 3. Air Force Systems Command, Washington, D.C., January 1965. (DDC No. AD 458-586).

A discussion of optimization which amplifies the material in Volume II, section IV is presented. Optimization principles, criteria and checklists, as well as a summary of various applicable techniques is included. A series of six examples are described covering a number of critical aspects of cost-effectiveness analysis in considerable detail. Treated in the examples are: (1) optimization of effectiveness based on reliability, maintainability, performance, and cost; (2) allocation of reliability requirements among subsystems; (3) payload allocation among three subsystems based on a fixed weight constraint; (4) determination of best checkout routine for a limited pre-launch test; (5) optimization of availability for a complex system; and (6) trade-off study between site hardening and dispersal for a missile system. (Author)

M110.0520 Hoch, Saul. *Cost Criteria in Weapon Systems Analysis and Force Studies.* Office of the Assistant Secretary of Defense (Comptroller), Washington, D.C., August 1965.

Discusses the application, interpretation, and estimation of costs used in cost-effectiveness or systems analysis studies. The type of studies examined are used in the comparison of military systems to perform a particular mission or set of missions. The manner in which costs are used in such studies is described. The possible modification of costs is considered prior to their introduction into the study to reflect their discounted present value, their residual value, and the credit due to their usefulness in other missions. The paper also discusses the merits of two types of studies, termed dynamic studies and static studies. In dynamic studies values are separately identified in each time period. In static costs, values over the time period concerned are summed.

M110.0540 Kaamins, M. *Economic-Physical Trade-offs in Scheduling Missile System Checkouts.* P-2567. The RAND Corporation, Santa Monica, California, March 1962. (DDC No. AD 606-688).

This paper is concerned with a portion of RAND's study of automatic checkout equipment, which was initiated late in 1958 at the request of the Air Force. The project objective was . . . . to establish the basic philosophy, concepts, and parameters for application of automatic test and checkout equipment to improve the operational readiness and employment of weapon systems. The primary activity then was to develop concepts, design methods and techniques, and decision aids to help make these test equipments and systems more effective, in short, to help make the best use of test equipment dollars to get the best weapon system performance.

M110.0560 Kermisch, J.J. and Tenzer, A.J. *On the Role of the Cost Analyst in a Weapon System Study.* P-3360. The RAND Corporation, Santa Monica, California, May 1966.

Discusses the use of cost analysis as part of cost-effectiveness analysis. The phases of cost-effectiveness analysis where cost analysis applies are identified as the equipment design, system design and force structure design phases. A study of an air defense weapon system is used for illustration purposes. The role of costs in equipment design is described together with the costs of various methods of operating the system.

M110.0580 Logistics Management Institute. *Cost Effective Weapon System Support.* Briefing Notes, Washington, D.C., September 1963. (DDC No. AD 472-957L).

The Logistics Management Institute is assisting the Department of Defense in identifying and developing improved weapon system initial support management practices and techniques. This is a continuing task which to date has been based primarily upon a series of depth studies of major weapon system programs. In July 1962, an LMI report on the Titan II program was released. This first ICBM system report was followed by the release of LMI's initial Minuteman program study in March 1963. The primary recommendations made in the two reports proposed: organizations of professional Air Force provisioning specialists; improved joint service-contractor usage of weapon system support assets (spares and wing-level support equipment, facilities and support system knowledge and data); and resident support teams (RST's) to perform continuous and responsive efforts. The material contained in these briefing notes is based upon LMI's recently completed follow-on initial support study which used the Minuteman programs (WS-113A + B) as research vehicles.

M110.0600 Logistics Management Institute. *Methods for Evaluating the Cost-Effectiveness of Alternative Support Plans for Major Weapon Systems.* Washington, D.C., September 1965. (DDC No. AD 476-471).

This report consists of two major parts: (1) a series of steps culminating in the development and demonstration of areas and ways in which economic criteria and quantitative methodology for assigning values to unit time increments of a weapon system's program life span can be systematically applied to optimize support plans with an

awareness of the impact of decisions on cost/effectiveness; and (2) as requested by the Department of Defense, assisting the DOD in the test application of the methodology to one or more weapon systems. The purpose of this report is to describe the results of efforts to date and to suggest an approach to continued work toward the objective of the task.

M110.0620 Madden, John L. *Maximum Time Policies.* OAR-6-F. Operations Analysis Office, Wright-Patterson Air Force Base, Ohio. February 1966. (DDC No. AD 477-705).

This report describes a basic, cost-effectiveness mathematical model for determining optimal maximum times for aircraft engines, and some modifications to the basic model to cover related problems. Two modified models are described. One is for determining the oldest engine that would be economical to use in lieu of using overhauled engines during aircraft phase-out programs. The other provides for determining optimal combinations of maximum time and jet engine base maintenance return rate policies. Related cost analyses are also provided, covering discussions of overhaul costs at depot and repair costs at bases, and sensitivity of the model to errors in input cost factors.

M110.0640 Madden, John L. *Maximum Time Policies.* Operations Analysis Report No. 6, Summary Edition. Air Force Logistics Command. Wright-Patterson AFB, Ohio. January 1966. (DDC No. AD 477-704).

A cost-effective mathematical model to determine optimal (least long run cost) maximum allowable operating times for aircraft engines is described. The model uses actuarial failure rates to forecast future engine repairs under different maximum time policies and then determines the costs for each policy by using average costs per engine repair. All significant logistics costs associated with each repair action are included, such as estimates of average removal and reinstallation costs, costs of transporting engines to and from the repair facility, and repair costs. Costs are also used for the extra spare engines required to support given maximum time policies, for the penalty associated with aircraft downtime, and for the risks associated with unscheduled engine failures.

M110.0660 McCall, J.J. *When to Stop Sampling and Initiate Product Improvement.* The RAND Corporation, Santa Monica, California, February 1962. (DDC No. AD 272-138).

The relation between information collection and product improvement is considered. A rule is developed whereby the decision-maker can determine when to stop gathering information and initiate product improvement. A simple technique is used for ranking product improvement candidates (sub systems). The ranking depends on (1) the subsystem's failure rate, (2) the number of subsystems of this type in the weapon system, (3) the cost in weapon system downtime of a subsystem failure, (4) the initial cost of the weapon system and (5) the weapon system's expected service life.

M110.0680 McMillan, Louis K., Jr. *Application of Cost Effectiveness Techniques to Selection of Preferred Warship Characteristics.* Master's thesis, Naval Postgraduate School, Monterey, California 1961. (DDC No. AD 481-402).

This paper discusses the applicability of cost-effectiveness methods to the problem of determining preferred design characteristics of surface, anti-submarine warships. A short introduction to the concept of cost-effectiveness as applied to military weapons systems is followed by a description of the methodology applicable to adapting cost-effectiveness techniques to selection of preferred warship design characteristics. The surface anti-submarine vessel is used as a vehicle for adapting the cost-effectiveness methodology; explanations as to how the cost-effectiveness model may be expanded to include other types of surface ships is included.

M110.0700 Monroe, A.J. *Achievements of the Weapon System Effectiveness Industry Advisory Committee.* TRW Space Technology Laboratories, presented at the 6th New York Conference on Electronic Reliability, May 21, 1965. TRW, Los Angeles, California 1965.

M110.0720 Monroe, Alfred J., Voegtlen, H. Dean, and Moxley, Frank H. *Weapon System Effectiveness Industry Advisory Committee (WSEIAC).* Final Report of Task Group VI, Chairman's final report, Air Force Systems Command, Washington, D.C., January 1965. (DDC No. AD 467-816).

The principal findings, conclusions, and recommendations of the five WSEIAC task groups are presented in summary form. The system effectiveness problem is examined in light of the task group investigations. A fifteen-step procedure for cost-effectiveness assurance is presented. Application of the method and results to be expected in each phase of a system life-cycle are described. The impact on existing disciplines is examined. A section of this integrated summary contains abstracts and summaries of each of the ten reports submitted by the five task groups. Appendix I contains a more detailed treatment of the fifteen recommended tasks. Appendix II presents an example of application of this methodology shown for a hypothetical system in the conceptual phase. Finally, Appendix III is a glossary of effectiveness/cost-effectiveness terms.

M110.0740 Mooz, W.E. *The B-X: A Hypothetical Bomber Cost Study, RM-4635-PR.* The RAND Corporation, Santa Monica, California, July 1965. (DDC No. AD 466-398).

Illustrates some of the techniques used at RAND for costing weapon systems. It describes how the cost analyst, when supplied with information concerning the characteristics of a weapon and its operation, makes an estimate of the resource required to develop, purchase, and operate the weapon as a system. It details the use of estimating relationships for such elements as engineering and tooling under research and development, investments in equipment and spares, and personnel and maintenance costs for operations. Sensitivity analysis is also described for applications regarding possible error and for examining the effects on cost of varying the operation of the system.

M110.0760 Naiman, J. *Analytical Cost Predictions for Advanced Weapon Systems.* USAF, Air Force Systems Command. Aeronautical Systems Division, Cost Analysis Information. Report 62-5. Wright-Patterson Air Force Base, Ohio, May 1962.

Describes the functions and operations of ASD's Cost Analysis Branch. The paper also discusses tools and techniques for advanced system cost prediction. The functions of the branch are described as (1) the cost data research program, (2) cost prediction analysis, and (3) cost-effectiveness analysis. The tasks involved in carrying out these functions are defined.

M110.0780 Nosenzo, Louis V. *A Model for the Cost Effectiveness Evaluation of Bomb Damage Assessment Systems.* Space Systems Division, Air Force Systems Command, Inglewood, California, January 1963. (DDC No. AD 296-047).

A model for the cost-effectiveness evaluation of bomb damage assessment systems.

M110.0800 Novick, D. *Concepts of Cost for Use in Studies of Effectiveness.* P-1182. The RAND Corporation, Santa Monica, California, October 1957. (DDC No. AD 244-030).

The two major considerations in a systems analysis are described as (1) weapon system effectiveness, and (2) the weapon system costs; the two approaches to the selection of preferred systems are the fixed effectiveness approach and fixed budget approach. For the fixed effectiveness case, minimum cost is the criterion for choice; in the fixed budget approach, maximum effectiveness is the criterion for selecting the system. This paper is concerned primarily with weapon system choice. The role of cost analysis and cost estimating is described in the context of campaign analysis and weapon studies.

M110.0820 Novick, D. *The Cost of Advanced Weapons.* P-2256. The RAND Corporation, Santa Monica, California, February 1962. (DDC No. AD 291-605).

Discusses the increasing cost of advanced weapon systems. The increased cost of new weapons is balanced by the need for smaller quantities, thus keeping defense expenditures relatively stable. The factors responsible for higher costs are described as greater needs for research and development and higher labor and material costs. Increased reliability requirements and the difficulty of achieving them are also discussed. Program budgeting and an improved costing capability are suggested to offset cost increases by providing better information for better decisions in the selection of weapons.

M110.0840 Novick, D. *Costing Tomorrow's Weapon Systems.* RM-3170-R. The RAND Corporation, Santa Monica, California, June 1962. (DDC No. AD 287-997). Also published in *The Quarterly Review of Economics and Business.* University of Illinois, Spring 1963.

The role of cost analysis, the usefulness of cost studies, reliability of estimates, and the direction of effort for improving costing techniques are discussed in this memorandum. Costing future weapon systems is a difficult and uncertain but essential process for budgeting and decision-making. The major cause of unreliability in estimates is the uncertainty in the specifications of future systems. Techniques, such as cost sensitivity analysis, should be improved in order to examine the effects of changes in program and system characteristics.

M110.0860 Novick, K. *Lead Time in Modern Weapons.* P-1240. The RAND Corporation, Santa Monica, California, December 1957. Also published as "Federal Spending for National Security," in *Federal Expenditure Policy for Economic Growth and Stability.* Joint Economic Committee Print, 85th Congress, 1st Session, U.S. Government Printing Office, Washington, D.C., 1957.

This reprint of testimony given before the Joint Economic Committee, Eighty-fifth Congress, presents a discussion of elapsed time or the lead time needed to acquire advanced weapon systems. Continuity of research is required if the time is to be kept reasonably short. Steps in the acquisition process are outlined with the usual time demands for each step. From product research to manufacturing, the likely lead time is 8-13 years; a possible lead time is 5-9 years; and an optimistic lead time is from 3-6 years. The government procedure for approving expenditures for weapon acquisition is discussed together with a description of its time requirement. The time lag between the authority to obligate funds and actual expenditures is also considered.

M110.0880 Novick, David, and Petruschell, R.L. *Cost Analysis of Individual Systems,* in J.P. Large (ed.). *Concepts and Procedures of Cost Analysis.* RM-3589-PR. The RAND Corporation, Santa Monica, California, June 1963. (For Official Use Only), pp. III-1-III-34, (DDC No. AD 411-554).

This chapter discusses the costing of individual USAF systems. Requirements for descriptive data for individual systems are outlined and illustrated by a ballistic missile system description. A chart of accounts is provided and the cost elements are defined. The R & D investment, and operating cost categories are discussed. Administrative and support costs are defined and related to the USAF organizational structure.

M110.0900 Pardee, F.S. *Weapon System Cost Sensitivity Analysis as an Aid in Determining Economic Resource Impact.* P-2021. The RAND Corporation, Santa Monica, Calif., June 1960. (DDC No. AD 224-289).

This paper describes cost-sensitivity analysis and its usefulness in military planning and operations. Cost-sensitivity analysis is defined as an examination of the financial implication of numerous alternatives to provide a range of values for the weapon system evaluation process. Illustrations show the range of costs associated with variations in certain system characteristics such as payload weight at missile salvo capability. Cost-sensitivity analysis is used to estimate the financial magnitude of total force structures, designs, test and operational concepts, and the time-phasing of such alternatives.

M110.0920 Petruschell, R.L. *Estimation of Requirements for Primary Mission Equipment,* in J.P. Large (ed.). *Concepts and Procedures of Cost Analysis.* RM-3589-PR. The RAND Corporation, Santa Monica, California, June 1963, (For Official Use Only), pp. VIII-1-VIII-22. (DDC No. AD 411-554).

This chapter describes a method for computing military system requirements for aircraft and missiles. The time-phasing of requirements and the use of cost-quality relationships for the procurement of equipment are outlined. A step-by-step procedure is presented for development of required quantities as derived from the mission needs.

M110.0940 The RAND Corp. *Generalized Cost Model.* Volume II, RM-2770-SSD. Interim Report on Phoenix Systems Cost. Santa Monica, California, April 1961.

This memorandum describes a generalized mathematical model for estimating the cost of space and ballistic missile booster systems. The model considers cradle-to-grave costs. The model does not apply solely to the Phoenix system; with the possible modification, it can be applied

to costing systems employing different operating concepts. Cost elements are described within the category structure –R & D costs, nonrecurring costs, and operating costs. Included are the subroutines for computing costs of flight vehicles, ground support equipment, and military facilities.

M110.0960 Reeves, J.R. Summary of *Cost Effectiveness Comparison for Tactical Fire Direction System. Volume I,* Bunker-Ramo Corporation, Fort Huachuca, Arizona, April 1966. (DDC No. AD 484-052).

The procedures and models used to compile and correlate the relevant data on costs and effects are summarized. Static, rather than dynamic, simulations were used to evaluate performance of selected artillery fire missions and target intelligence. The capability of each alternate system was evaluated under varied conditions of tactical situation, message loads, and munitions mixes. Using basic system implementation costs and ammunition costs, the total cost of achieving a desired level of effectiveness was computed for each system. Within the limiting framework of the criterion for cost-effectiveness, trade-off factors were restricted to variations in computer speeds in the preferred system. Trade-off computations indicated a range of acceptable computer speeds at comparable costs. It was concluded that the optimum system met the criterion established for the study. The automated systems proved more effective than the manual system, at less cost.

M110.0980 Rogin, L. *Maintainability Design Factors and Operations Analysis.* Naval Air Development Center. Johnsville, Pennsylvania, May 1963. (DDC No. AD 460-991).

A cost-effectiveness model is evolved and analytical inputs are discussed. An airborne weapon system is employed to illustrate model applicability. Subsystem characteristics (power plant, airframe, avionics, etc.), which determine the over-all system characteristics are analyzed. Mission definition, in terms of the operational plan-for-use, is related to these characteristics to provide estimates for system availability, effectiveness and cost. Use and readiness data provide useful model input information. The importance of gathering and analyzing maintainability data is emphasized.

M110.1000 Rosenberry, W.W., Dick, D.N., Patterson, C.L., Gawitt, M.A., Goodwin, R.W. *Sea Hawk Preliminary Cost-Effectiveness Study on Ship Control Subsystems.* Marine Engineering Lab, Annapolis, Maryland. May 1964. (DDC No. AD 440-326L).

This cost-effectiveness study was conducted to evaluate the broad range of ship control systems available within the state-of-the-art to determine the area for final system development to be employed on the Sea Hawk ship. System objectives were defined. The selected systems were divided into three subsystems, and ideal subsystems were defined for each objective. Subsystem configurations were devised, and their ability to meet the objectives rated. Each subsystem cost was estimated, and the subsystems were combined into six ship control systems. The subsystem costs were summed, and the effectiveness of the system derived. The cost effectiveness of each system was compared to an ideal system. This study concludes that a significant increase in effectiveness can be achieved without any increase in cost over the present system. The final system will be determined by examining several systems in the region of the most effective systems after consideration is given to several pertinent facts.

M110.1020 Sacco, William J. and Masaitis, Ceslovas. *A Linear Programming Formulation of a Weapons Allocation Problem.* Ballistic Research Labs. Aberdeen Proving Ground, Maryland. February 1965. (DDC No. AD 464-898).

A weapons allocation problem of current interest in weapons evaluation studies is formulated as a linear program.

M110.1040 Sacco, William J. and Schlegel, Palmer. *An Application of Dynamic Programming to Cost-Effectiveness Studies.* Ballistic Research Labs, Aberdeen Proving Ground, Maryland, September 1963. (DDC No. AD 425-743).

A mathematical model was developed for use in conducting cost-effectiveness studies, wherein the objective of the cost-effectiveness study is to determine alternative families of fire support weapons which will provide a given level of effectiveness for minimum weight and cost.

M110.1060 Sacco, William J. and Schlegel, Palmer R. *A Dynamic Programming Approach to a Cost-Effectiveness Problem.* Ballistic Research Labs, Aberdeen Proving Ground, Maryland. February 1965. (DDC No. AD 616-524).

The selection of an optimal weapon system on a cost-effectiveness basis is formulated as a mathematical-programming problem. The problem is solved using the functional equation technique of dynamic programming. The determination of certain 'appropriate' values for the arguments of the functional equations is illustrated by a numerical example. The arguments are obtained in a systematic manner by resorting to the construction of auxiliary, bookkeeping tables.

M110.1080 Samuels, Gerald L. and Perdue, George T. *Costs and Schedules Associated with Fielding the Tactical Fire Direction System.* Bunker-Ramo Corporation, Fort Huachuca, Arizona. April 1966. (DDC No. AD 484-046L).

Costs and schedules associated with fielding the tactical fire direction system.

M110.1100 Schlenker, George J. *Foundation of a Weapons Cost-Effectiveness Methodology.* Army Weapons Command, Rock Island, Illinois. August 1964. (DDC No. AD 444-758).

Improvement in competitive weapon effectiveness enhances survivability. This fact and the fact that combatants have a value to their government which must be protected have been shown to justify a quantitative expenditure in an improved tactical weapon system. Total, economically justifiable, system investment is related to the improvement in competitive position obtainable through such an investment. The results of deterministic and stochastic combat models are described and used in the effectiveness methodology.

M110.1101 Schlenker, George. *Optimum Reliability Goals.* Weapons Operations Research Office, Army Weapons Command, Rock Island Arsenal, Illinois, October 1966. (DDC No. AD 803-650).

This report presents a methodological approach to the problem of assigning a reliability goal to a functional subsystem prior to development. The reliability that one attempts to achieve in a new development has implications for the costs which are incurred in all phases of the life of

the system. Expected RDT and E costs increase monotonically with increasing MTBF goals, but expected O and M costs decrease monotonically with increasing MTBF achieved in development. These facts suggest that the expected total lifetime cost of ownership for the system, i.e., all units in the system, has a minimum value for some MTBF goal. This value of the MTBF goal is viewed as optimal. To find it the report addresses the problem of constructing a quantitative model relating lifetime, system ownership cost to the reliability goal. The effect upon the optimal goal of variations in input parameters is investigated for a specific numerical example.

M110.1120 Schlosse, K.P. *Cargo Aircraft Cost Model.* Directorate of Operations Research. Research and Technology Division, Wright-Patterson Air Force Base, Ohio. November 1965.

This report contains a detailed description of a cargo aircraft cost model. The cost methodology is described for estimating system costs for RDT & E, system acquisition, and operations. The model is particularly applicable to estimating costs of CTOL and V/STOL cargo aircraft. Included in the report are the cost category format, technical characteristics, printout requirements, the cost model, cost definitions, input requirements and model requirements for technical inputs.

M110.1140 Quade, E.S. *Military Systems Analysis.* RM-3452-PR. The RAND Corporation, Santa Monica, California. January 1963. (DDC No. AD 292-026).

Systems analysis is described as an approach to complex problems of choice under uncertainty by systematically examining the costs, effectiveness, and risks of the various alternatives. The problems and procedures of such analysis when applied in the military context are surveyed. Total systems analysis requires numerous sub-studies – for example, operations research, cost analysis, war gaming, etc. The stages of systems analysis are outlined and discussed as (1) the formulation, (2) the search for data, (3) explanation through model development, (4) interpretation and (5) verification.

M110.1160 Sebring, H.C. *Cost-Effectiveness Logic for Missile Weapon Systems Selection.* Presented at the Ninth International Meeting of the Institute of Management Sciences, September 10-11, 1962, held jointly with the Econometric Society. University of Michigan, Ann Arbor, Michigan; General Electric Co., Missile and Space Division, Philadelphia, Pennsylvania. July 1962. (DDC No. AD 412-348).

The logic for an effectiveness comparison of missile weapon systems is presented. The measure is defined as the number of a selected target set that can be neutralized with a fixed probability by each weapon system, of which the gross force is determined from a selected fixed budget. An important part of the logic is target destruction assessment, and mathematical methods are presented to determine the numbers of hard and soft targets that can be neutralized by the net forces of each weapon system. A basis is provided for weapon system selection since each can be evaluated in terms of numbers of potentially destroyed targets. A separate investigation of the warhead requirements for area targets is presented as an appendix.

M110.1180 Sebring, H.C. *An Effectiveness Model for Satellite Threat Systems.* Presented at the 29th National Meeting of the Operations Research Society of America, May 18-20, 1966, Santa Monica, California. General Electric Company, Missile and Space Division, Philadelphia, Pennsylvania. May 1966. (DDC No. AD 481-843).

A model is explicated for the effective measurement of satellite threat systems. The criterion is for the cost to achieve and X% neutralization expectancy of a satellite force. A passive decoy defense, multiple threat vehicles per booster, and multiple object inspections per threat vehicle are assumed. Although analyses of systems performance and cost effectiveness are made with nomograms, for a full parametric analysis the model can be programmed. The model is detailed in a network chart, forming a basis for Monte Carlo simulation logic. Trade-off curves relate numbers of threat vehicles and numbers of inspections (orbit transfers) per vehicle. Quantitative effectiveness examples are presented for three postulated candidate systems.

M110.1200 Sebring, H.C. *Missile Weapons Systems Effectiveness Logic.* General Electric Co., Syracuse, N.Y. Presented at the 19th Meeting, Operations Research Society of America. May 25-26, 1961. (DDC No. AD 412-334).

The logic for an effectiveness comparison of missile weapons systems is presented. The effectiveness measure is defined as the gross force cost to destroy selected numbers and categories of targets, each with a fixed probability. Mathematical methods are presented to determine the net and gross force requirements to attack hard point targets and soft area targets. With appropriate modifications, the logic and methodology are applicable to other weapons systems types. A basis is also provided for optimum target assignments among weapons systems since each theoretical attack can be evaluated in terms of cost.

M110.1220 Shoemaker, H.L. *Summary of the Technical, Economic, and Military Factors Study, Volume I.* Bunker-Ramo Corp., Fort Huachuca, Arizona, April 1966. (DDC No. AD 484-044).

Technical, economic, and military factors study (TEMS) for the tactical fire direction system (TFDS) was undertaken to provide a quantitative basis on which to assess the validity of system requirements, to document experimental work accomplished and other work required to assure that the concept formulation period had been completed, and that the TFDS was ready for engineering development. This document summarizes the TEMS effort which shows that the TFDS is ready for engineering development, that mission/performance envelopes have been defined and optimized for technical approaches have been selected, and that feasible and credible cost and schedule estimates have been made.

M110.1240 Siegel, Arthur I. and Wolf, J. Jay. "A Technique for Evaluating Man Machine System Designs," *Human Factors,* Vol. 3 (March 1961), 18-28.

A computer based method for digitally simulating the performance, in one-operator systems, of operators who possess various characteristics is described. The method is believed applicable for evaluating various system designs while the system is in the early design stage. Two operational tasks, landing an F4D aircraft on a carrier and firing an air-to-air missile, were simulated using the method. The predictions from the model were compared with outside criterion data for the same tasks. The predictions are held to conform generally with reality and to be reasonable. The results of the two applications of the model were in general agreement. It is held that the model may be considered sound and may now be tentatively employed for comparative evaluation of alternative system designs or for predicting system performance.

M110.1260 Smith, Cheryle C. *An Analysis Method for Determination of Transport Aircraft Cost Effectiveness.* Research and Technology Division, Air Force Systems Command, Washington, D.C., July 64. (DDC No. AD 447-654L).

This report describes a method of analyzing the relative operational capabilities and cost-effectiveness of transport aircraft in performing a variety of logistic missions with respect to limited war and general war situations. A wide selection of world route structures may be used, with or without the inclusion winds. A mathematical model, programmed for the Remington Rand model 1103A Univac Digital computer, has been developed for computation of aircraft productivity indices and fleet sizes required to fly any number of sorties, or to deploy any number of tons of bulk cargo or quantized-type cargo to a destination point within a fixed total deployment time. Aircraft payloads may be of constant size, maximum size depending on payload-range capability, or otherwise limited size. Productivity indices have been combined with unit aircraft annual costs to yield cost-effectiveness factors, which may be used for aircraft comparisons or for least-cost fleet mix predictions.

M110.1280 Sobin, B. *Some Interest Rate Aspects of Weapons Systems Investment Policy.* Research paper. Institute for Defense Analyses, Arlington, Virginia. 1965.

Presents a formal examination of the theoretical basis for the use of interest rates in weapons systems evaluations and an analysis of economic data that yield a numerical estimate of a suggested rate of interest.

M110.1300 Sotelo, R. *Weapon System Costing for Strategic Air Command–Initial Investment and Annual Operation and Maintenance.* DC-9905 as revised. The Boeing Airplane Company, Seattle, Washington, January 1964.

Describes a methodology developed for determining program costs of Strategic Air Command aircraft systems. Such costs are developed as part of presentations to the military and in the evaluation of new aircraft design. The B-52H system is used, with illustrative values, for an example of the development of program costs. Cost element lists and corresponding estimating equations are included. The cost elements within each cost category are outlined and described. Methods for developing personnel requirements are also described.

M110.1320 Summers, R. *Cost Estimates as Predictors of Actual Weapon Costs: A Study of Major Hardware Articles.* RM-3061-PR. The RAND Corporation, Santa Monica, Calif., March 1965. (DDC No. AD 329-265).

Consists of a statistical study of the accuracy of past cost estimates. The purpose of the study is to assess the probable accuracy of cost estimates of major hardware that are still in development. The study is based on a sample of 68 estimates for hardware used in 22 weapon systems. Techniques are derived and presented for the purpose of decreasing uncertainty about future hardware costs.

M110.1340 Sweetland, Anders. *Assessing the Impact of Weapon System Modifications by Field Study: A Feasibility Demonstration.* The RAND Corp., Santa Monica, Calif., November 1964.

Studies have been made on ways to increase the productivity of the Air Force maintenance management system. These studies have suggested adding clock hours and status data to the current data system (AFM 66-1, Maintenance Management,) and have proposed the use of computers in maintenance management and analysis. These additions have made practicable analyses of maintenance data that were heretofore deemed impossible. The memorandum continues the previous line of inquiry. It demonstrates how these adjuncts to the present system may be used to assess the cost and effectiveness of engineering modifications. The procedures are described using two examples: An engine modification of T-38A aircraft and a fire-control system modification of F-101B aircraft. The two procedures are then contrasted to show how the combination of methods can provide the most meaningful set of data. It is shown how the method of recording and analyzing may also be used to provide a history of the installation-check-out process during this vital period.

M110.1363 Tenzer, A.J. *Cost Sensitivity Analysis.* P-3097. The RAND Corporation, Santa Monica, California, March 1965.

Discusses how cost sensitivity analysis can provide a meaningful method for handling uncertainty in cost estimates. The paper also contains a discussion of how cost sensitivity analysis can be used to compare alternative weapon configuration and operational plans. The use of sensitivity analysis is demonstrated with the use of a weapon system study for defense against submarine-launched ballistic missiles. The illustration shows how costs are sensitive or insensitive to the value of particular parameters, and how within certain ranges cost would or would not change significantly. It is also illustrated how quantitative values can be developed to reflect cost uncertainty.

M110.1380 U.S. Department Air Force Systems Command. Weapon System Effectiveness Industry Advisory Committee (WSEIAC). "Prediction–Measurement (Summary, Conclusions, and Recommendations)". Report No. AFSC-TR-62-2 Vol. I. Final Report of Task Group II, Washington, D.C., January 1965. (DDC No. AD 458-454).

Concepts of system effectiveness measurement and prediction, presented in detail in Volume II, are summarized briefly in this volume. Eight formalized tasks necessary to evaluate effectiveness are reviewed. Summaries of four illustrative examples, presented in detail in Volume III, are given. These examples provide useful guidelines for effectiveness at various phases of system life cycle.

Conclusions concerning the present state of system effectiveness evaluation are presented. A series of recommendations are proposed for Air Force adoption.

M110.1400 U.S. Air Force Systems Command. Weapon System Effectiveness Industry Advisory Committee (WSEIAC). *Prediction–Measurement (Concepts, Task Analysis, Principles of Model Construction).* Report No. AFSC-TR-65-2. Vol 2. Final Report of Task Group II, Wash., D.C., January 1965. (DDC No. AD 458-455).

Concepts of system effectiveness including the three principal terms, availability, dependability, and capability, are presented. Eight specific tasks required to evaluate effectiveness during any phase of system life are presented. A mathematical routine appropriate to effectiveness model construction is described. Using the above task analysis and the model framework, a hypothetical example is presented. Results of the evaluation illustrate effectiveness analysis methods and possible alternate decisions available. Application of simulation methods to the example are discussed. The appendices contain summaries of four typical examples of the application of effectiveness evaluation methods to various air force systems (presented in detail in Volume III.)

An airborne avionics system, an intercontinental ballistic missile system, a long range radar surveillance system, and a spacecraft system are described

M110.1420 U.S. Department of Air Force Systems Command. Weapon System Effectiveness Industry Advisory Committee (WSEIAC). *Final Report of Task Group II.* Report No. AFSC-TR-65-2, Vol. 3. Washington, D.C., January 1965. (DDC No. AD 458-456).

This technical supplement is concerned primarily with four examples of effectiveness evaluations. The systems involved are: the Avionics System in a tactical fighter-bomber; a squadron of intercontinental ballistic missiles; a fixed radar surveillance and threat evaluation system and, a spacecraft system. An attempt was made to illustrate procedures employed at different phases of development. The evaluation of the avionics system takes place during program definition; the ICBM squadron, during operation, the radar system, during definition and operation; and the spacecraft, during acquisition. Each example is intended to illustrate to a different level of detail, various aspects of the evaluation.

These examples do not purport to illustrate all possible methods of application and use of the evaluation procedures. Rather they are intended to show some methods for applying the concepts, areas of flexibility in their application, and some uses which might be made of the evaluations.

M110.1440 U.S. Air Force Systems Command, Weapon System Effectiveness Industry Advisory Committee. *Summary, Conclusion and Recommendation.* Final Report of Task Group IV, AFSC-TR-65-4, Volume I, Washington, D.C., January 1965.

M110.1460 U.S. Air Force Systems Command, Weapon System Effectiveness Industry Advisory Committee. *Task and Analysis Methodology, Cost Effectiveness Optimization.* Final Report of Task Group IV, AFSC-TR-65-4, Volume II, Washington, D.C., January 1965.

M110.1480 U.S. Air Force Systems Command, Weapon System Effectiveness Industry Advisory Committee. *Technical Supplement, Cost Effectiveness Optimization.* Final Report of Task Group IV, AFSC-TR-65-4, Volume III. Washington, D.C., January 1965.

M110.1500 U.S. Department of the Army, Army Engineer Strategic Studies Group. *Cost-Effectiveness of the Nuclear-Powered Energy Depot (NPED) For the Army Field Forces.* Washington, D.C., June 1966. (DDC No. AD 486-907).

A system analysis, or cost-effectiveness study, is made of the limited war application of the nuclear powered energy depot which produces fuel or energy for vehicle propulsion in the field. Objectives and benefits expected from the use of an alternative fuel or energy source are examined. Simulations of six limited war scenarios generated operational data and costs for use in comparing the alternatives of nuclear powered energy systems with pol. Program costs were determined and analyzed. No nuclear powered system was found to be operationally or cost-wise competitive with cheap, efficient, abundant, and easily handled and stored petroleum.

M110.1520 U.S. Department of Defense. *Logistics Research Conference.* Volumes II-VII, Washington, D.C., 1965. (DDC No. AD 623-231).

Contents: Cost effectiveness analysis within the Army; cost effectiveness projects in the Department of the Navy; recent mathematical modeling/cost effectiveness projects in the Department of the Air Force; military essentiality; cost effectiveness for integrated logistics support systems and equipment (DOD Directive 4100.35); summary and evaluation of recent work in measuring the productivity of federal agencies; chance-constrained programming and related approaches to cost effectiveness; three levels of analysis of cost-effectiveness associated with personnel attitudes and attributes; committee decisions.

M110.1540 Van Ormer, H.P. *Tactical Situation Selection (TEMS TFDS) Cost-Effectiveness Study Report.* Volume 1, Bunker-Ramo Corp., Fort Huachuca, Arizona, February 1966. (DDC No. AD 484-056).

This report documents the four tactical situations within which the performance of important artillery missions is to be analyzed to determine the best tactical fire direction system configuration considering cost-effectiveness.

M110.1560 Westerman, Dean P. and Mathias, Ronald F. *A Cost Model for Use in Cost-Effectiveness Analyses of Dissimilar Weapon Systems.* Ballistic Research Labs, Aberdeen Proving Ground, September 1964. (DDC No. AD 453-842).

A model is presented for the determination of system costs in cost-effectiveness studies of dissimilar weapon systems. The assumptions employed are listed so that an adaptation of the model may be made to fulfill individual study requirements.

M110.1580 Wohlstetter, Albert J. and Others: *Selection and Use of Strategic Air Bases.* April 1954; A report prepared for U.S. Air Force Project Rand. R-266. The RAND Corporation, Santa Monica, California, 1963.

An example of a systems analysis.

Research Effort

M120.0100 Brunner, E.D. *The Cost of Basic Research Effort: Air Force Experience, 1954-1964.* RM-4250-PR. The RAND Corporation, Santa Monica, California. February 1965.

It has long been apparent that the costs of basic research have been increasing. The extent of the increases and their incidence among the several elements of cost, the various scientific fields, and the different types of research organization, however, have already been matters of conjecture. This study is a first attempt to provide information for planning and budgeting on the costs of accomplishing basic research projects financed by the USAF Office of Aerospace Research during fiscal years 1954-1964.

M120.0152 Heinemann, Robert W. *An Objective Approach to Program Planning.* TM-1345. Ammunition Engineering Directorate Picatinny Arsenal, Dover, New Jersey, December 1964. (DDC No. AD 454-071).

Research and Development funds expended on systems which never reach the field waste huge sums of money every year. This fact is accepted as inevitable on the basis

that only a limited number of the completed studies will meet with sufficient success to permit field use. The reasons for dropping the other studies involve factors such as complexity of design, manufacture or operation, cost, marginal or no improvement, unreliability, safety problems, lack of requirements, lack of funds, unfeasibility or aborted studies. This report outlines a program which, if properly developed, would yield the required information to objectively analyze proposed major programs. Further work is required to formulate the program into a workable and useful management tool. (Author)

M120.0162 Marshall, A.W. and Meckling, W.H. *Predictability of the Costs, Time and Success of Development.* P-1821. The RAND Corporation, Santa Monica, California, December 1959. (DDC No. AD 244-160).

Presented in this paper are the results of research into the extent and nature of uncertainty in Air Force development projects. The general conclusions are that early estimates are usually low because of over-optimism and error. Changes in design and plans as development proceeds are largely responsible for the inaccuracy of the original estimates. Data are presented showing total factor increases in the costs of various types of military aircraft. The factors express differences between the earliest available estimates and the actual cost. The technological advancement necessary and basic uncertainty are the major determinants of the size of the error.

M120.0200 Metz, William W. *A Study of R & D Effectiveness of a Small USAF Organization Employing Time, Cost, and Performance Factors of Contracted Effort.* Air Proving Ground Center, Eglin AFB, Florida, October 1964. (DDC No. AD 454-536).

The observation has been made by several sources that government research and development is characterized by a unique set of uncertainties, which differentiate it from the market system operating in the business world. This study was undertaken to determine the effectiveness of the R & D procurement phase in the technical field of airborne targetry. Three crucial areas were examined: performance, development time, and development cost. A representative sample of 25 R & D contracts in the technical area of airborne targets and components, completed in the last six years, was used in the case studies. Analysis and evaluation of the predictability of cost, time, and performance of the end items lead to the conclusion that development cost and time predictions exhibited a decided bias toward overoptimism. This tendency to underestimate development time and cost of targetry equipment was shown to be in agreement with previous studies on larger, more complex, weapons systems. Major factors contributing to development cost increases included technical difficulty, competitive optimism, additional scope, and change in overhead rates.

M120.0273 Scherer, F.M. *Time-Cost Tradeoffs in Uncertain Empirical Research Projects.* Princeton, New Jersey, Department of Economics, Princeton University, March 1966. (DDC No. AD 636-512). Also published in *Naval Research Logistics Quarterly,* Vol. 13, No. 1 (March 1966), 71-82.

This paper explores the relationship between research project cost and expected time to completion under various scheduling strategies; it assumes that many potential technical approaches to the research problem can be identified; and that each approach has a low but definite subjective probability of success. It is shown that under a variety of assumptions, expected time to project completion can be reduced, but that as a result expected project cost rises at an increasing rate. Some cases in which this convex time-cost tradeoff relationship might not hold generally are identified. When the time-cost tradeoff function is convex, the desirability of concurrent as opposed to series scheduling of approaches depends crucially upon the depth of the stream of benefits expected to be realized upon successful project completion. The deeper the benefit stream is, the more desirable concurrent scheduling is.

M120.0300 Stoodley, Francis H. *A Study of Methods Which Could Improve the Relevance of Naval Applied Research and Exploratory Development.* Office of Naval Research, Washington, 1966.

M120.0400 Trinkl, F.H. *The Art of Applying Cost Effectiveness Analysis to the Selection of R & D Projects: Application to Military Space Systems.* Office of Assistant Secretary of Defense, Department of Defense, Washington, D.C., October 9, 1964.

Support Equipment

M200.0100 AMCEL Propulsion Co. *An Analytical Study to Determine Cost Effectiveness of Retrorocket Propulsion Systems.* Asheville, N.C., September 1965. (DDC No. AD 478-306).

Detailed information is presented in the form of curves and graphs which compares the cost effectiveness of approximately sized retrorocket systems used for the delivery of small munitions from high-speed, low-flying aircraft. Retrorocket system requirements to launch a variety of munitions from varying conditions of launch and target were determined and the requirements compared with existing retrorocket systems. Design data was evolved which can be applied to retrorockets so that they will meet the requirements. Also, the effects of variation from ideal conditions were analyzed and the results were utilized in a cost-effectiveness analysis. From these analyses, evaluation of retrorockets propulsion systems to accomplish range reduction can be made on the basis of launch conditions, munition characteristics, and rocket motor characteristics as compared to cost effectiveness.

M200.0200 Bellaschi, J.J. *A Cost-Effectiveness Evaluation of Three Alternative Boats for the Navy Land-Based Search and Rescue (SAR) Function.* Naval Weapon Systems Analysis Office, Quantico, Virginia, June 1965. (DDC No. AD 476-948).

A cost-effectiveness study showed that the best choice was the conversion of existing boats to diesel power.

M200.0300 Bomberger, E.E. and Flagg, D.L. *Study Using Tradeoff Methodology Developed For Selection of Chemical Alarm Systems.* Budd Co., Philadelphia, Pa. February 1965. (DDC No. AD 460-397).

Ten CW alarms are ranked according to their relative military worth using a method based on the measurement of user preferences. The measurement of these preferences is described and the results are summarized quantitatively. The hypotheses that the opinions sampled do not depend statistically on either the military post of the person questioned or on whether he is classified as a member of combat arms or services are tested. An analysis of the responses yields estimates on the values the parameters must meet if an alarm is to be acceptable to at least 85% of the sample.

M200.0400 Hopkins, N.J. and Marr, H. "Cost-effectiveness of a Surveillance Device for an Anti-aircraft Weapon System," *Canadian Operations Research Society Journal,* Vol. 4, No. 3 (November 1966), 149-64.

A computer model used in the evaluation of a weapon system is described. Cost-effectiveness analysis was used to decide not to purchase an additional piece of equipment.

M200.0500 Szego, George C. *Economics, Logistics, and Optimization of Fuel Cells.* Institute for Defense Analyses, Research and Engineering Support Division. Arlington, Virginia, December 1965. (DDC No. AD 477-429).

The higher efficiency of fuel cells could lead to important military and civilian applications, in both traction and stationary power. This would greatly reduce the cost and logistic burden of military ground mobile operations and provide other important benefits in the civilian sector. Atmospheric pollution would also be reduced. In addition, it is shown that due to torque characteristics, vehicles can be built with much lower powers of electric drive motors than the internal combustion prime mover yielding comparable performance. An analysis is made which shows that average automotive engine efficiency in use is only about 8.38. The latest authoritative fuel and oxidizer costs are presented and an optimization program is applied. It is shown that the greatest over-all economies are realized at lower current densities than are now being striven for. Efficiency at lower current density is correspondingly greater. The systems for hydrogen, hydrazine, and methyl alcohol, with both oxygen and air for the oxidizer, are analyzed and the data presented, including capital amortization and operating costs.

M200.0520 Szten, Emil M., Edwards, William W., Jacobson, William H., Jr., Simmons, Kenneth R. and Sprang, William O. *Operational-Requirements-Cost-Effectiveness Study of QMR for a New ¼ Ton Truck.* Research Analysis Corp., McLean, Virginia, September 1964. (DDC No. AD 452-728L).

This study has revealed that a vehicle can be produced to meet all essential requirements specified in the QMR for a new ¼ ton truck, with the exception of reliability. Reliability as stated in the QMR is unrealistically high and beyond the present state of the art. There will be some reduction of land mobility due to the floating capability requirements. The cost of the floatable vehicle would be higher than the desired target cost by 46%. An austere vehicle can be produced for the desired target cost of $1900, but this vehicle would not be the most effective vehicle for its initial and operational cost. The vehicle determined the most suitable by this study does not differ greatly from the present M151. (Author)

PERSONNEL

M300.0100 Baldwin, Edwin M. *An Analysis of the Cost and Requirements of the Fleet Ballistic Missile Submarine Personnel Subsystem.* Master's Thesis. Naval Postgraduate School, Monterey, California, 1963. (DDC No. AD 480-913).

The cost of personnel manning submarine weapons systems is subjected to a cost-benefit analysis. Hypothetical examples are used to develop a technique of comparing the effectiveness of various alternatives to the method now being used.

M300.0120 Cox, William A. *Redeployment of Troops to Reduce U.S. Spending in Europe: An Economic Analysis.* Report No. S-155. Institute for Defense Analysis, Economic and Political Studies Division. Arlington, Virginia, September 1964. (DDC No. AD 471-493L).

Alternate plans for improving the balance-of-payments position by returning various components of military equipment and manpower to the U.S. are investigated and compared by calculating costs per dollar of overseas spending reduced.

M300.0140 Heuston, M.C. *Concepts for Estimating Air Force Manpower Requirements for Planning Purposes.* RM-2611-PR. The RAND Corporation, Santa Monica, California, December 1960. (DDC No. AD 250-725).

The basic concepts for preparing manpower estimates for current and, particularly, advanced Air Force systems are discussed in this memorandum. The procedures provide total system manpower requirements, including operations, unit administration, maintenance, support and prorations for logistic support, and higher headquarters administration. A series of steps is outlined for estimating personnel for advanced systems. Worksheets and sample formats, including cost elements, are included.

M300.0160 Jackson, Robert J., Mann, Lawrence O., Jr., and Primas, Walter H., Jr. *Officer Personnel Costs for Use in ASW Surface Ship Systems Cost-Effectiveness Comparisons.* ND-65-63. New Developments Research Branch Bureau of Naval Personnel, Washington, D.C. June 1965. (DDC No. AD 476-465L).

This report presents cost for officers estimated to man an ASW surface ship (DE type). However, costs are considered appropriate for other surface type officers. Officer cost data presented are designed for use in cost-effectiveness studies for projects in the RDT + E cycle. (Author).

M300.0180 Losee, J.E., *et al. Methods for Computing Manpower Requirements for Weapons Systems Under Development.* USAF, Air Force Systems Command, Washington, D.C. Aeronautical Systems Division. Technical Report 61-361, August 1961.

A method of forecasting the manpower requirements of new weapon systems is described in this report. The manning estimate is derived through a series of integrated steps leading to position descriptions and numbers of men required. The prediction of manpower for a new weapon system requires data on (1) operational, logistics, and maintenance concepts, (2) reliability of components and subsystems, and (3) statistical estimates of occurrence rates. A checklist of data requirements is included. The procedure consists of the development of a task equipment analysis, a task frequency analysis, a time requirement analysis, direct maintenance personnel requirements, and flow charting for inclusion in the completed Air Force Qualitative and Quantitative Personnel Requirements Information Program.

M300.0200 Mann, L.O., Primas, W.H. and Jackson, R.J. *Enlisted Personnel Costs for Use in ASW Surface Ship Systems Cost-Effectiveness Comparisons.* ND-65-40. Personnel Research Division, Bureau of Naval Personnel. Washington, D.C., December 1964.

Presents personnel costs for the twenty-seven ratings envisoned as being utilized in ASW surface ship systems and related subsystems.

The personnel cost data provided are presented in Section II in two tabular listings; (1) cumulative cost per pay grade for each rating reported and (2) cumulative cost per year per pay grade for each rating. These listings differ considerably from the first and second enlistment type costs employed in the previous SEA HAWK personnel cost reports. The latter cost listings did not allow the conciseness and flexibility required for cost-effectiveness comparisons. The method employed in this memorandum has made an attempt to include all known cost elements paid by the government in support of enlisted personnel.

M300.0220 Petruschell, R.L. *Total System Personnel Estimating.* in J.P. Large (ed.). *Concepts and Procedures of Cost Analysis.* RM-3589-PR. The RAND Corporation, Santa Monica, California, June 1963, p. XII-1-XII-25, (DDC No. AD 411-554).

This chapter presents methods and data sources for developing personnel estimates for individual systems. The procedures apply to the number of personnel required but not to their cost. Manned aircraft and missile systems are discussed separately. The steps in the procedure apply to (1) operation personnel, (2) maintenance personnel, (3) administration personnel, and (4) support personnel. A detailed example is given for a manned aircraft system.

M300.0223 McGrath, Joseph E. and Nordie, Peter G. *Synthesis and Comparison of System Research Methods.* Report No. 9, Human Sciences Research, Incorporated, McLean, Virginia, February 1960.

In 1958, Human Sciences Research, Incorporated initiated a research program aimed at synthesis of system research methodology under sponsorship of Personnel and Training Branch, Psychological Sciences Division, Office of Naval Research.

The central objective of Phase I was to review methodologies of system research studies to attempt to construct a useful set of concepts for organizing and comparing research methods, and to evaluate the potential fruitfulness of such an approach for providing a synthesis of system research methods. Phase II was basically an extension of the procedures used in the Phase I feasibility study, in order to modify and elaborate the concepts which had been developed.

M300.0240 Piekarz, Rolf. *Cost and Foreign-Exchange Savings Associated with Domestic Deployment of U.S. Forces Now in Europe.* Arlington, Va., Institute for Defense Analyses. August 1964. (DDC No. AD 450-035).

In general, high costs would result from trying to improve the U.S. balance of payments by expanding airlift capacity and prepositioning equipment to substitute for deployment of army combat units in Europe. Over a five-year period such actions would add from 9 to 25 dollars to the DOD budget for each 1 dollar improvement in the U.S. balance of payments.

For example, the procurement and maintenance of the incremental airlift capacity and additional equipment stocks for an armored battalion would cost from 23 million to 37 million dollars and result in about a 1.5 million dollar foreign-exchange saving. Even if the presently programmed air transport capacity could satisfy the additional airlift requirements, this approach still would necessitate spending from 3 to 11 dollars for prepositioning for each 1 dollar improvement in the U.S. balance of payments. To illustrate, a 16-million dollar outlay over a five-year period for the procurement and maintenance of additional stocks for an armored battalion would be required to obtain a 1.5 million dollar foreign-exchange saving. Prepositioning is cheaper than airlift if both must be procured in addition to existing prepositioning and airlift capacity. A 1-million dollar expenditure for prepositioning would lower airlift expenditures by at least 12 million dollars and perhaps by 60 million dollars over a five-year period. (Author)

M300.0260 Smith, Marven Matthews. *An Analysis of the Development and the Future of the Naval Selected Air Reserve.* Master's Thesis, Naval Postgraduate School. Monterey, California, 1965. (DDC No. AD 475-287).

The organizational development, legislative background and some historical highlights of the present day Naval Selected Air Reserve are presented. The various facets of the existing organization including the support groups and the flying and nonflying components are outlined with respect to mission, capabilities, requirements cost and effectiveness. The present and forseeable military-economic situation is examined with respect to the capabilities and requirements of the Naval Selected Air Reserve and then the feasible alternatives to perform the missions presently envisioned for the Naval Selected Air Reserve are examined. Finally, recommendations as to the most desirable of these alternatives are presented.

M300.0280 Tenzer, A.J., Hansen, O., and Roque, E. M. *Relationships for Estimating USAF Administrative and Support Manpower Requirements.* RM-4366-PR. The RAND Corporation, Santa Monica, California. January 1965. (DDC No. AD 611-587).

Presents the results of a study conducted to develop a generalized method for estimating future administrative and support personnel requirements. The study pertained to bases of the Strategic Air Command, Tactical Air Command, Air Defense Command, and the Military Air Transport Service which are located within the continental United States. From an examination of statistical data it was found possible to estimate the relationship between operations and maintenance personnel and the number of administrative and support personnel. The specific estimating relationships for the major commands and for major systems are presented.

M300.0300 U.S. Department of the Navy, Bureau of Naval Personnel, Personnel Research Division, New Developments Research Branch. *Enlisted Personnel Costs for Use in SEA HAWK Cost-Effectiveness Comparisons.* Report No. ND 64-63. First Report, Washington, D.C., May 1964.

Provides "... information on personnel costs to be used in cost-effectiveness comparisons being conducted for the SEA HAWK project." It "... utilizes existing BUPERS cost methodology that has been developed in earlier reports, and in some instances additional consideration."

"This SEA HAWK personnel cost report is divided into two major parts. The first part presents in detail the method of computation of personnel cost figures and discusses ways of implementing personnel costs in SEA HAWK Program evaluations. The second part presents cost data sheets for twenty-seven ratings."

CIVIL DEFENSE

M400.0100 University of Arizona Engineering Research Lab. *Local Civil Defense Systems: A Study of Counterforce Defense Systems Methodology*

Applied to Tucson, Arizona and Environs. Final report. Tucson, Arizona, June 1964. (DDC No. AD 603-216).

A pilot study of specified counterforce defense systems applied to Tucson, Arizona, and its environs, is presented. Using data on targeting, weapons system parameters, and nuclear effects supplied by the Office of Civil Defense, the report attempts to: (A) Define the attack consequences on the pilot study area and its environs including the interaction of the uses of multiple weapons, disturbed airflow effects and fallout climatology; (B) Develop a detailed set of plans for a variety of feasible shelter systems based on a cost-effectiveness analysis; and (C) Identify the training requirements of the proposed protective systems. The contract was conducted in phases which corresponded closely to the following: (A) targeting analysis, (B) pertinent surveys, (C) load predictions, (D) evaluation of surveys and loads on shelter requirements, (E) conception of feasible shelter systems, (F) evaluation of feasible systems, (G) cost-effectiveness analysis, and (H) identification of training requirements.

M400.0120 Bresee, J.C. *Civil Defense Research at Oak Ridge National Laboratory.* AEC No. ORNL-P-1093. Tenn., Oak Ridge National Lab., 1965.

The technical feasibility and cost estimates of urban civil defense shelters are discussed. The tunnel-grid shelter concept is reviewed and design and engineering data are presented for a city in which one million people live. The interconnected tunnel-grid could house all inhabitants and is based on the use of standard 8 ft. diameter reinforced concrete pipe with an 8-in.-wall. The tunnel would include bunk space for 4 adults every 6 ft., or 3500/mile. With all bunks folded back, walking space 5 ft. wide would be available, and with one bunk folded down an aisle space of 3 ft. and seating space for 4 in. 6 ft. would be provided. Forced air ducts, water pipes, and electrical power cables are located under the floor. The cost for an elaborate system with refrigeration and power plants was estimated at $400 to $500 per person and more austere systems could be built for $300 to $400 per person. A number of dual uses for a tunnel-grid shelter system are suggested that would help to minimize the cost. (C.H.)

M400.0140 Guess, Floyd M. *Sensitivity Analysis of Civil Defense Systems and Components. A Cost-Effectiveness Computer Procedure for Optimum Allocation of Fallout Shelter System Fund Under Uniform or Variable Risk Assumptions.* R-OU-157. Research Triangle Institute, Durham, North Carolina, October 1965. (DDC No. AD 624-701).

The dynamics of civil defense planning and systems evaluation require a procedure that yields approximate answers to questions concerning effective fall-out shelter improvement programs. To accomplish this a computerized model for the CEC 3600 is developed and demonstrated for OCD region 6. The model permits an evaluation of shelter improvement programs against any fall-out environment, but it is particularly valuable when risk-type expressions of the probable fall-out environment are used as inputs.

Using detailed data from the national fall-out shelter survey and equally detailed estimates of the probable fall-out hazard in a small area (counties, in the demonstration), the extent to which an area's population is inadequately protected is determined.

Fall-out shelter system funds are then allocated to areas of need in an optimal manner. The allocation employs shelter cost data obtained from phase 2 of the national fall-out shelter survey on ventilation and shielding improvements. Estimated costs for package ventilation (PKV) and shelter in new construction are also employed in the demonstration in OCD region 6. In all, 14 cost studies are run, using selected combinations of the budget level, the fallout risk level, etc.

M400.0147 Hawaii. Civil Defense, Department of Defense. *Hawaii Emergency Resources Planning Project.* Draft completed, date of publication indefinite.

Initiated by Civil Defense Division, Department of Defense, to study the management and control of the essential resources of the State in an emergency. This study was conducted by twelve task groups comprised of persons from industry, union, government and the armed forces.

M400.0160 Moon, Albert E. *Population in Shelter: A Method for Measuring the Effectiveness of Radio Warning.* Stanford Research Institute, Menlo Park, California. November 1965. (DDC No. AD 478-479).

This report contains charts, worksheets, and instructions which permit a user to compute the fraction of the national population which will be able to reach fallout shelters within specified times. The computation of fraction of population in shelter may be performed for warning systems made up of combinations of radio warning, indoor alerting, siren alerting, and no-alerting modes. Fraction in shelter may be determined for the posture of existing shelter spaces as well as for a full fallout shelter posture. Examples of the computation are presented, as well as examples of application of fraction in shelter as a measure of effectiveness. An appendix describes the mathematical basis of the computation and the sources of data which went into the preparation of the charts.

M400.0180 Neblett, John H., Floyd M. Guess, H. Rodney Sink, and K.E. Willis. *Sensitivity Analysis of Civil Defense Systems and Components. Introduction and Summary.* Research Triangle Institute, Operations Research and Economics Division. Durham, North Carolina. October 1965. (DDC No. AD 624-704).

The document summarizes a three-part study concerning sensitivity analysis of CD systems and components in a fallout environment. In the first, a cost/effectiveness computer program is developed for optimum allocation of fallout shelter system development funds under uniform or variable risk asssumptions. This program, intended for use in OCD planning studies, is programmed for the CDC 3600. It is applied in example studies using data on OCD Region 6. The second part of the study is a sensitivity analysis of selected parameters based on 8 SMSA's. It employs the transportation algorithm in a study of movement of people to fallout shelters. The results show how estimated casualties vary as movement-to-shelter patterns vary from restriction to a standard location up to free movement within the SMSA. They also indicate that detailed planning for shelter utilization can be very effective in reducing expected fallout casualties when the number of shelter spaces exceed the population of an SMSA. In the third part of the study, a generalized sensitivity analysis is made of the parameters used in fallout vulnerability analysis models which determine total dose and equivalent residual dose.

M400.0200 Walker, Sylvia M. *Radiological Recovery Requirements, Structures and Operations Research. Volume III. Decontamination Analysis of Selected Sites and Facilities in San Jose, California.* Research Triangle Institute, Operations Research and Economics Division, Durham, North Carolina, June 1966. (DDC No. AD 635-823).

The volume contains the cost and effectiveness data for decontamination analyses of sixteen sites and facilities in San Jose, California. Costs are measured in team-hours of effort. Decontamination effectiveness is measured in terms of fractions of dose-rate remaining at specified detector locations and fractions of dose remaining for persons who perform functions requiring specified daily activity patterns at the sites and facilities chosen.

OTHER USEFUL ITEMS

Analytical Techniques

A000.5000 Wildavsky, Aaron. "The Political Economy of Efficiency: Cost Benefit Analysis, Systems Analysis and Program Budgeting," in "Planning-Programming-Budgeting System: A Symposium," *Public Administration Review*, Vol. XXVI, No. 4 (December 1966), 292-310.

Systems analysis, program budgeting and cost-effectiveness analysis involve a great deal more than economizing and efficiency. They can have far-reaching effects on the structure of a political system. The author argues these points and attempts to strengthen his position by identifying what the new techniques can and cannot do.

Wildavsky discusses the underlying economic and political assumptions of cost-benefit analysis. He covers the limitations and mixed benefits of this technique. Systems analysis is treated in a similar way. It is defined, compared with other techniques, and evaluated. Finally, the character and role of program budgeting are assessed. How are programs conceived? How are ends separated from means? Answers to these and other questions are given.

In conclusion the author points out the imbalance created by the emphasis on economizing. The economic emphasis should not outweigh the concern for the political dimensions. This will happen "if political rationality continues to lack trained and adept defenders."

Bibliographies

A001.0060 DonVito, P.A. *Annotated Bibliography on Systems Cost Analysis.* RM-4848-1-PR. The RAND Corp., Santa Monica, Calif., March 1967.

The bibliography includes books, pamphlets, articles, papers, and technical and research memoranda. Written materials carrying security classification have not been included. A brief description is presented of the nature of the work. The materials were selected and included solely on the basis of their relevance to the subject matter of systems cost analysis. No interpretation or evaluation of the work was intended. Titles have been grouped into categories reflecting broad areas of cost analysis and its application in the Department of Defense. This bibliography was prepared for the use by the growing number of costs analysts, particularly those being organized at various levels of the Air Force. The titles and their annotation are intended to permit cost analysts to learn of earlier work that may be relevant to study at hand. The memorandum contains the first revision and updates the bibliography. Additional revisions are planned for the future, in order to include material that becomes available after the date of this memorandum.

These items of interest are included in the present bibliography by the courtesy of the RAND Corporation.

A001.0080 Pearman, Elizabeth H. *Bibliography on Cost-Benefit Analysis and Planning-Programming-Budgeting.* Research Analysis Corporation, McLean, Virginia, 1966.

All items listed in this bibliography are also listed in the present bibliography.

A001.0090 RAND Corporation, Santa Monica, Calif. *Selected Rand Publications on Program-Budgeting.* SB-1008. Santa Monica, Calif., September 1966.

The items appearing in SB-1008 are reproduced in this bibliography.

A001.0100 Rizzardi, Ned W. *Cost Optimization: A Partially Annotated Bibliography.* Lockheed Missiles and Space Co., Sunnyvale, California, October 1965. (DDC No. AD 478-263L).

This compilation containing 132 references pertains to cost optimization techniques. Emphasis is focused on arriving at cost figures rather than performance.

A001.0120 Stromer, Peter R. *Long-range Planning and Technological Forecasting: An Annotated Bibliography, Supplement I, Special Research Bibliography.* Lockheed Missiles and Space Company, Sunnyvale, California, February 1965. (DDC No. AD 457-949).

Annotated bibliography on long-range planning and technological forecasting.

A001.0140 U.S. Bureau of the Budget, Library. *Program Analysis Techniques: A Selected Bibliography.* December 1965. Revised 1966.

The items to be found here have been included in this bibliography.

A001.0160 Defense Documentation Center, Alexandria, Virginia. *Cost: Analysis and Methodology* Operations Research Series, Volumes I and III, March 1967.

The relevant material in these items is reproduced in this bibliography.

A001.0180 Defense Documentation Center, Alexandria, Virginia. *Cost-Effectiveness Analysis.* Operations Research Series, Volume III, March 1967. (DDC No. AD 808-901).

Annotated bibliographies.

A001.1000 Webb, J. Scott, *et al. A Selected Annotated Bibliography on Cost-Effectiveness and Man/Machine Function Allocation.* U.S. Naval Personnel Research Activity, San Diego, California, August 1965. (DDC No. AD 468-834).

This bibliography includes the references and summaries of over 100 publications pertaining to system costs, system effectiveness, cost-effectiveness ratios, and man/machine function allocation.

Cost-Benefit Analysis

A002.0120 Devine, E.J. "Treatment of Incommensurables in Cost-Benefit Analysis," *Land Economics,* (August 1966), 383-387.

A002.0140 Drewnowski, Jan., "Cost-Benefit Analysis in the Light of Some Work of the United Nations

Research Institute for Social Development (UNRISD) on the Role of Social Factors in Development," *Cost-Benefit Analysis of Social Projects.* Geneva, United Nations Research Institute for Social Development, April 1966.

Discusses the use of cost-benefit analysis at UNRISD and the problems that have arisen in its use, particularly from the conflicting claims and demands of national versus area goals.

A002.0160 Feldstein, Martin S. "Opportunity Cost Calculations in Cost-Benefit Analysis," *Public Finance,* Vol. 19, No. 2 (1964), 117-139.

Investigates various concepts of the social opportunity cost rate proposed in discussions of cost-benefit analysis.

A002.0180 Feldstein, Martin S. "The Social Time Preference Discount Rate in Cost-Benefit Analysis," *Economic Journal,* Vol. 74 (June 1964), 360-379.

A002.0260 Hammond, Richard J. "Convention and Limitation in Benefit-Cost Analysis," *Natural Resources Journal,* Vol. 6 (April 1966), 195-222.

A critical appraisal of the present application of cost-benefit analysis techniques.

A002.0280 Haver, C.B. *Secondary Benefits.* N.R. Paper No. 5. Chicago, Ill., University of Chicago, September 23, 1955.

A002.0320 Peters, G.H., "Cost-Benefit Analysis: Illusion or Godsend?", *Statist,* Vol. 185 (September 1964), 755-757.

A002.0380 Sewell, W.R.D. *et al. Guide to Benefit-Cost Analysis.* Ottawa, Canada, Queen's Printer, 1965. Also in Burton, Ian and Kates, Robert W. (eds.). *Readings in Resource Management and Conservation,* Chicago, University of Chicago Press, 1965, 544-557.

A002.0420 Tolley, George S. and Harrell, Cleon. "Extensions of Benefit-Cost Analysis," *American Economic Review,* Vol. 52, No. 2 (May 1962), 459-473.

The author says that the development of benefit-cost analysis has given impetus for agencies to collect data and make analyses leading to serious estimates of the worth of projects. Impressive results lead to the question of whether methodological improvements are needed. This article raises several questions about the assumptions underlying benefit-cost analysis, which lead to suggestions for procedural modifications.

A002.0440 Williams, Alan. *Cost/Benefit Analysis. A Bibliography of Theoretical Issues and Practical Applications.* Heslington, York, England, Department of Economics, University of York, October 1966.

Cost-Effectiveness Analysis

A003.0020 Abert, J.G. *Some Problems in Cost Analysis.* Research paper. Institute for Defense Analysis, Research and Engineering Support Division, Arlington, Virginia, June 1965. (DDC No AD 469-240).

The implementation of each system of alternatives under consideration in a cost-effectiveness study would result in a time stream of effectiveness and a time stream of costs. Because there is no absolute way of evaluating the worth of future effectiveness or future costs, it is often impossible to compare these streams. In such situations discounting is often used to make a logical, though not direct comparison. But discounting should not be used to account for uncertainty. If the effectiveness of a weapons system is in doubt because of uncertainty considerations, then discounting should not be used. The effectiveness calculation itself should account for uncertainty.

A003.0040 Alchian, A. *Costs and Outputs.* P-1449. The RAND Corp., Santa Monica, Calif., September 1958. (DDC No. AD 607-003).

This paper examines the relationship between costs and outputs. Graphic and tabular examples are included. A distinction is made between the rate and the quantity of output. Delivery dates are shown to be a major feature of the cost-output relationship. Long-run and short-run effects on such relationships are also discussed.

A003.0060 Allen, Jodie T. *An Individual System/Organization Cost Model. Volume II. Computer Program Design and Operation.* Technical paper. Research Analysis Corp., McLean, Virginia, January 1966. (DDC No. AD 477-651).

The model was designed to permit rapid computerized costing of alternate systems or organizations. It employs an iterative procedure to test the sensitivity of costs to perturbation in activity assumptions and other cost characteristics. The program, written in FORTRAN IV, is composed of a preprocessing phase, an input phase, and an iterative alternative calculation phase. Output is written for each perturbation of activity assumptions or systems or organization characteristics.

A003.0120 Bell, Chauncey F. *Cost-Effectiveness Analysis as a Management Tool.* P-2988. The RAND Corp., Santa Monica, Calif., October 1964. (DDC No. AD 607-134).

Defines cost-effectiveness analysis, considers its strengths and weakness, and demonstrates the construction of cost-effectiveness models. Concludes that though cost-effectiveness is time-consuming and may lead to over-confidence in the results of the analysis, the same short-comings are inherent in all management decisions and that cost-effectiveness is a very valuable management tool.

A003.0140 Berkson, J. "Cost-Utility as a Measure of the Efficiency of a Test," *Journal of the American Statistical Association,* Vol. 42 (1947), 246-255.

A003.0160 Blumstein, Alfred. *The Choice of Analytical Techniques in Cost-Effectiveness Analysis.* Research paper. Institute for Defense Analysis, Research and Engineering Support Division, Arlington, Virginia, October 1965. (DDC No. AD 625-947).

The model is shown to provide a means for determining effectiveness as a function of the controllable variables in terms of the uncontrollable variables. Different kinds of problems are shown to be best treated by different

available means, namely, operational exercises, gaming simulation, and analytical methods.

A003.0180 Breckner, N.V. and Noah, J.W. *Costing for Systems Analysis.* Center for Naval Analysis of the Franklin Institute, Philadelphia, Penna., March 1966. (DDC No. AD 636-273).

The comparative analysis of alternative systems and a method of structuring and synthesizing cost estimates are presented. The methods of estimating costs from inappropriate or inaccessible data are discussed. Avenues for further work on these problems are explored.

A003.0240 Daniels, E.J. and Lanthrop, J.B. *Strengthening the Cost-Effectiveness Criterion for Major System Decisions.* ORSA-TIMS. Minneapolis, Minnesota, October 1964.

A003.0300 Fields, D.S. "Cost/Effectiveness Analysis: Its Tasks and Their Inter-relation," *Operations Research,* Vol. 14, (May 1966), 242-66, 515-27.

Studies of the cost/effectiveness of specific systems and mathematical techniques used in such investigations have frequently been presented at ORSA meetings and published in *Operations Research.* A few other papers have described the general theory of cost/effectiveness or a special approach to one or more of the major tasks involved in its application. This paper discusses the nature of these tasks and how they are interrelated, using as an example the design of a communication system in a nuclear environment. (Author)

A003.0320 Goldman, Thomas A. (ed.). *Cost-effectiveness Analysis: New Approaches in Decision-making.* New York, Frederick A. Praeger, 1966.

A003.0360 Grosse, Robert N. *Principles of Cost Effectiveness Analysis.* U.S. Industrial College of the Armed Forces, No. L66-24. Fort Leslie J. McNair, Washington, D.C., 1966.

A003.0380 Heuston, M.C. *Generalized Cost-Effectiveness Procedures.* Texas Instruments, Dallas, Texas, Volume 17, July 1964.

A003.0400 Heuston, M.C. and Ogawa, G. "Observations on the Theoretical Basis of Cost Effectiveness," *Operations Research,* Vol. 14, No. 2 (March-April 1966), 242-266.

Presents a description of the elements of cost-effectiveness analysis. The general background of cost-effectiveness analysis is discussed within the context of its development in the DOD. The general characteristics and the steps of an analysis are described. Cost-estimating techniques and system characteristics are considered as two aspects of the cost model. A general system effectiveness model is also discussed, together with a combined cost effectiveness model.

A003.0460 Hoag, M.W. *The Relevance of Costs in Operations Research.* P-820. The RAND Corp., Santa Monica, Calif., April 1956. (DDC No. AD 422-838). Also published in *Operations Research,* Vol. 4, No. 4 (August 1956), 448-459.

This paper describes the types of problems in which cost considerations become important. The real cost of a course of action is defined as the value of the alternative objectives that are sacrificed for its attainment. If resources or inputs are specific to one use, cost considerations are not important; but they become important when two or more objectives compete for limited resources. Such problems are illustrated with graphics showing the substitutability of inputs for a given objective. The difficulty of establishing real cost is described.

A003.0480 Jakobsberg, W. "Cost-effectiveness; What It Is and How to Use It," *Management Review,* Vol. 55 (June 1966), 35-43.

A003.0520 Kazanowski, A.D. *Cost Effectiveness Fallacies and Misconceptions.* Paper prepared for the Eleventh Annual Meeting of the Western Section, Operations Research Society of America, 29 September – 1 October 1965.

Contains a discussion of limitations in the practice of cost-effectiveness analysis. The fallacies and misconceptions described are as follows: (1) the use of a single criterion for effectiveness, (2) the assumption that all criteria can be quantified, (3) the assumption that all criteria can be related to a dominant criterion, (4) reliance on the ability to weigh criteria, (5) the lack of reliability in assigned probabilities of outcome, (6) the use of fixed amortization periods, (7) the derivative fallacy, (8) the belief that effectiveness can be maximized while costs minimized, (9) the neglect of spillover effects, and (10) the belief that valid games can be devised for complex situations.

A003.0540 Kazonowski, A.D. *Cost-Effectiveness Methodology and Limitations.* North American Aviation, Inc., Downey, Calif., Space and Information Systems Division. October 1964.

This report in discussing cost-effectiveness analysis is not intended to be a textbook for its practice. It is meant as an examination, with illustrations, of the more common fallacies and misconceptions that tend to invalidate the application of cost-effectiveness analysis. Valid approaches and methodologies are also described, together with areas that appear profitable for additional investigation.

A003.0560 McCullough, J.D. *Cost-Effectiveness: Estimating: Systems Costs.* The RAND Corp., Santa Monica, Calif., September 1965.

Prepared for presentation on a panel on 'The Use and Estimation of Costs at symposium on Cost-Effectiveness Analysis sponsored by Washington Operations Research Council 14-16 June 1965.'

The discussion of concepts, principles, and the general approach toward the development of system cost estimates is intended primarily for users of estimates, rather than for cost analysts. An understanding of cost analysis can assist considerably in the use of cost estimates. Both the value and limitation of such estimates should be better understood for their proper application in cost effectiveness analysis. Emphasis must be shifted toward an evaluation of the validity of the study itself and the analysis underlying it. Data, methods, and conclusions must be subjected to intelligent and critical review.

A003.0580 Nathan, I. *A Figure-of-Merit Cost Effectiveness Evaluation Model.* General Precision Aerospace Systems Division, Wayne, New Jersey, 1964.

A003.0620 O'Neill, Daniel D., Westerman, Dean P., and Sacco, William. *Cost-Effective Analyses.* Ballistic Research Labs, Aberdeen Proving Ground, Maryland, March 1966. (DDC No. AD 635-168).

Methods for the conduct of cost-effectiveness studies and formats for the presentation of results are presented.

A003.0640 Peterson, Robert L. "The Use and Misuse of Cost-Effectiveness," (March-April 1966) Vol. 17 *Air University Review*, 81-84.

Illustrates the effect of different viewpoints in drawing conclusions from a cost-effectiveness analysis.

A003.0660 Quade, E.S. *Cost-Effectiveness Analysis: An Appreciation.* P-3248. The RAND Corp., Santa Monica, Calif., October 1965. (DDC No. AD 623-105).

This paper contains a discussion of the nature and scope of cost-effectiveness analysis. The purpose of the paper is to point out its proper role as an aid to decision-making. Cost-effectiveness analysis is described as characterized by a systematic and rational approach, with assumptions made explicit, objectives and criteria clearly defined, and alternative courses of action compared.

A003.0680 Quade, E.S. *Cost-Effectiveness: An Introduction and Overview.* P-3134. The RAND Corp., Santa Monica, Calif., May 1965. (DDC No. AD 616-339).

Cost-effectiveness analysis is defined as any analytical study designed to assist a decision-maker in identifying a preferred choice from among possible alternatives. Examples of aspects of such analysis that may be of even greater significance are: the specification of the right objectives, devising satisfactory measures of performance, non dollar costs, and the discovery of better alternatives. The elements of analysis are described as (1) the objective, (2) the alternatives, (3) the costs, (4) a model and (5) the criterion for choice. The limitations of analysis are discussed and include the 'attention' bias, incompleteness, and the difficulty in measuring effectiveness.

A003.0700 Quade, E.S. *Cost-Effectiveness: Some Trends in Analysis.* P-3529. The RAND Corp., Santa Monica, Calif., March 1967.

Cost-effectiveness analysis is not a static craft; while it still may be more an art than a science, its practitioners are constantly striving to widen its area of application and to improve it by introducing better methods of analysis. New approaches and techniques are being proposed constantly. Most of these are primarily mathematical in nature, but a few are directed toward a better treatment of those aspects of its problems that cannot be handled by purely quantitative methods. Emphasis in this paper will be on the latter. The author does not attempt to be comprehensive but merely notes three trends involving, respectively: computers; mathematics; and the direct use of expertise. The author discusses the first two only briefly, but describes the last in some detail.

Cost Prediction

A004.0100 Dienemann, Paul F. *Estimating Cost Uncertainty Using Monte Carlo Techniques.* RM-4854-PR. The RAND Corp., Santa Monica, Calif., January 1966.

Discusses a technique for expressing cost estimates of future systems as probability distributions to reflect the uncertainty of the estimate. The relationship between the sources of uncertainty and systems cost estimates is depicted as an input-output model. Within this framework a procedure is presented to estimate probability distributions, a Monte Carlo procedure is used for generating a series of systems cost estimates. Frequency distributions and statistical measures are then prepared from the set of output estimates to describe the nature and magnitude of the system cost uncertainty. An example is presented using an hypothetical aircraft system.

A004.0120 Eisemann, D.M. *The Progress Curve Computer.* P-1492. The RAND Corp., Santa Monica, Calif., September 1958. (DDC No. AD 224-123). Also published in *Operations Research*, Vol. 7, No. 1 (January-February 1959), 128-130.

This paper describes the use of the progress curve computer, a device to obtain average, unit, and total costs for all quantities of output from 1 to 1,000. The progress curve consists of a logarithmic grid upon which a family of curves is presented. It shows the cost implications of varying the levels of output and indicates differences between average prices and unit prices.

A004.0180 Fisher, G.H., "Costing Methods" in E.S. Quade, (ed.). *Analysis for Military Decisions.* R-387. The RAND Corp., Santa Monica, Calif., November 1964. (DDC No. AD 453-887). Also published by Rand-McNally, Chicago 1964, Chapter 15, p. 264-299.

This chapter is concerned with how cost is estimated and taken into account in a system analysis. The principles and concepts of cost analysis are discussed together with their application in individual systems and force structure costing. An illustration is included of a system description used as the basis for costing. A discussion is also included regarding the nature and composition of the major cost categories. Cost sensitivity analysis is described with examples for its use.

A004.0200 Fisher, G.H. *Derivation of Estimating Relationships: An Illustrative Example.* RM-3366-PR. The RAND Corporation, Santa Monica, Calif., November 1962. (DDC No. AD 290-951). Also published as Chapter V, "Use of Statistical Regression Analysis in Deriving Estimating Relationships," in J.P. Large, (ed.). *Concepts and Procedures of Cost Analysis.* RM-3589-PR, The RAND Corporation, Santa Monica, Calif., June 1963, pp. V-1-V-83. For Official Use Only, (DDC No. AD 411-554).

This memorandum illustrates how statistical regression analysis can be used to derive estimating relationships from historical data. The specific illustration pertains to estimating relationships for initial tooling cost as a function of aircraft performance and physical characteristics. Examples of the use of simple linear regression, logarithmic linear regression, second degree regression, and multiple linear regression analysis are discussed. Instructional problems are included in appendices.

A004.0300 Galin, M.P. and Capelletti, J.M. *The Central Technical Cost Library.* TM-3136. The MITRE Corp., Bedford, Mass., July 1961.

Describes the MITRE Central Technical Cost Library, which has been established to provide a comprehensive depository for cost, economic, and resource data and to accomplish the receipt, indexing, storage, and recovery of the information gathered. Three appendices describe (1) the library organization, (2) procedures, and (3) method for implementation. The abstracting of material

and its preparation for indexing and classifying are explained. Exhibits are included showing the library forms.

A004.0340 Jannsen, T.J., Glazer, H. and Des Roches, J.C. *User's Manual for the Computerized Electronic System Cost Model.* Mitre Corp., Bedford, Mass., October 1964.

The Economic Factors Department of MITRE has developed a computerized electronic system cost model as part of its work in system cost methodology. This document describes the initial version of the model and gives instructions for the electronic data processing procedures, including presentation of the key punch input forms, computer output formats, and a description of the computer program logic. The model, currently operational, has been programmed for the IBM 7090 and requires a 32,768 register core memory. The objectives of this manual are to provide a Primer for the cost analyst, and a Reference Manual for the detailed operations on the use of the model.

A004.0341 Margolis, M.A. *Cost Analysis: Concepts and Methods Outline.* P-3344. The RAND Corp., Santa Monica, Calif., 1966. (DDC No. AD 631-169).

Outline of a talk given in April 1966, as part of a lecture series sponsored by the American Institute of Aeronautics and Astronautics.

A004.0360 Large, J.P. (ed.). *Concepts and Procedures of Cost Analysis.* RM-3589-PR. The RAND Corp., Santa Monica, Calif., June 1963. (DDC No. AD 411-554).

This collection of previously published studies discusses the basic concepts of cost analysis, as well as certain specialized procedures for estimating the cost of particular types of equipment. The areas covered are (1) total force structure cost analysis, (2) cost analysis of individual systems, (3) estimating relationships, (4) derivation of estimating relationships, (5) uncertainty, (6) estimation of R & D costs of large launch vehicles, (7) equipment requirements, (8) aircraft costing, (9) missile costing, (10) estimation of installations requirements, and (11) estimation of total system personnel.

A004.0380 Marvin, K.E. "An Approach to Cost Estimating by Formulas," *NAA Bulletin,* (July 1960), 31-42.

This article contains a discussion of the derivation and use of mathematical formulas for cost estimating. Conversion of plotted points to numerical relationships makes it possible to develop reliable cost estimates rapidly, which is highly advantageous in business operations. Steps in the process are outlined, including the selection of relationships and the collecting and plotting of data.

A004.0400 Marvin, K.E. "Development and Potentials of a Formula Estimating Capability," *NAA Bulletin,* (October 1963), 19-21.

Describes the nature and usefulness of formula estimating, and includes examples of its application. The process requires the continuous integration of highly skilled manual analysis and the handling of massive computations. Included are data collection, data reduction, the development of mathematical relationships, and cost estimation through the rapid selection and solution of such relationships.

A004.0420 McClenon, P.R. *Cost Finding Through Multiple Correlation Analysis.* P-2619. The RAND Corp., Santa Monica, Calif., August 1962.

The development of cost estimates through the use of multiple correlation analysis is described in this paper. The technique can be used as an alternative for cost finding when regular cost accounts are not available. The discussion includes an example of the computation and a description of data requirements for correlation analysis.

A004.0460 Noah, J.W. and Smith, R.W. *Cost-Quantity Calculator.* RM-2786-PR. The RAND Corp., Santa Monica, Calif., January 1962. (DDC No. AD 279-346).

This memorandum explains the use of the Cost-Quantity Calculator, a device included with the document. The calculator provides cost analysts with a tool for constructing and interpreting cost-quantity relationships, also referred to as learning, progress, or improvement curves. The two most common types – the log-linear cumulative average curve and the log-linear individual unit curve – are defined and their differences and interactions are explained.Tables of slope-quantity factors are provided for applying relationships.

A004.0500 Petruschell, R.L. "An Introduction to Estimating Relationships," J.P. Large (ed.). *Concepts and Procedures of Cost Analysis.* RM-3589-PR. The RAND Corp., Santa Monica, Calif., June 1963, p. IV-1-IV-28, (DDC No. AD 411-554).

This chapter describes cost estimating relationships, their derivation, and the data for dependent variables and generating activities. Various display forms depicting relationships are presented. The use of cost estimating relationships is explained and an example is provided to illustrate a method for deriving such relationships.

A004.0540 Schlosser, K.P. and Lyon, B., *Cost Data Bank -- Problem Areas.* Cost Analysis Information Report 62-4. USAF Air Force Systems Command, Aeronautical Systems Division, May 1962.

Describes a cost data research project to establish a centralized facility for the collection, storage, and retrieval of cost estimating relationships and related data. Problem areas in establishing such a data bank are described. The form, source, and amount of data required are discussed, together with updating, mechanization, and workloads.

A004.0560 Slivinski, S.C. *The RAND Cost Analysis Department Data Bank.* P-2985. The RAND Corp., Santa Monica, Calif., September 1964. (DDC No. AD 606-581).

Contains a description of the cost data bank maintained at the RAND Corporation. The physical arrangement and operation of the facility are explained. Sources of data for cost analysis are discussed together with the manner in which useful data are extracted for inclusion in the data bank. The organization and classification of the cost data files are outlined and discussed along with considering automation for the facility.

A004.0580 Sobel, S. *A Computerized Technique to Express Uncertainty in Advanced System Cost Estimates.* Mitre Corp., Bedford, Mass., November 1965. (DDC No. AD 624-894).

The technique described presents a method to express uncertainty quantitatively in advanced system cost estimates. In particular, the technique suggests the employment of subjective probability distributions, which describe the

uncertainty in each system element. To determine an approximate distribution for total system cost. A 7090 program was written to perform the computational operations. (Author)

A004.0640 Yaross, A.D. *Cost Prediction Based on CER Utilization.* Cost Analysis Information Report 62-6. USAF, Air Force Systems Command, Aeronautical Systems Division, May 1962.

Reviews statistical techniques for developing cost estimating relationships or cost factors. A cost estimating relationship or cost factor is defined as a functional expression which states that the cost of an item may be predicted on the basis of one or more independent variables. The difficulty of developing such factors and relationships is discussed. Illustrations show the application of data and techniques. Historical contractor cost information provides a base for system cost predictions. The selection of variables is assisted by the use of measures of dispersion to determine their reliability for estimating. Relationships can be measured by correlation and regression analysis. The use of this diagram, and index numbers is also discussed.

A004.0680 Yates, E.H., Stanfield, H.M., and Nance, D.K. *A Method for Deriving Confidence Estimates in Cost Analysis.* Technical Memorandum 231. Defense Research Corporation, Santa Barbara, Calif., March 1966.

Discusses the problem of uncertainty in cost estimating and the consequent errors. The primary cause of uncertainty is identified as incompleteness in defining systems under consideration. The method discussed entails the assignment of estimated probability distributions at the cost element level of detail. The most likely value and the range are derived from the dispersion in the sample from which the CERs are derived.

PPBS Techniques

A005.0120 Fisher, G.H. *The Role of Cost Utility Analysis in Program Budgeting.* RM-4279-RC. The RAND Corp., Santa Monica, Calif., September 1964.

This is a do-it-yourself introduction to CBA and includes a discussion of its uses and interesting examples. It is a non-mathematical presentation which views CBA as primarily a management tool, enabling lower-level personnel to present the total picture of a proposed project to management in a way that makes the administrator's task less time-consuming.

A005.0140 Fisher, Gene H., "The Role of Cost-Utility Analysis in Program Budgeting," *Program Budgeting, Program Analysis and the Federal Budget,* ed. by David Novick. Cambridge, Mass., Harvard University Press, 1965, 61-80.

Fisher divides program budgeting into three segments: (1) structural aspects which are concerned with establishing a set of categories oriented primarily toward outputs; (2) the analytical process which requires using various analytic tools systematically; (3) information systems which will support the first two items. Fisher's primary concern is for one particular analytic approach of the second segment–cost utility analysis.

A005.0160 Fisher, G.H. *The World of Program Budgeting.* P-3361. The RAND Corp., Santa Monica, Calif., A talk presented to a Conference on Program Budgeting and Cost Analysis, University of California, May 1966. (DDC No. AD 633-069).

Major characteristics of a program budgeting system are listed as structural or format aspects, the analytical processes, and the data or information systems applicable. Guidelines to be followed in carrying out a cost-utility analysis are: proper structure of the problem and design of the analysis; conceptual framework (fixed utility or fixed approach); building the analytical model; treatment of uncertainty; treatment of problems associated with time; validity checking, and qualitative supplementation. Illustrations of program budget formats are given for the department of defense and for transportation.

A005.0180 Goldman, A.S. *Risk and Uncertainty in Cost-Effectiveness and Budgeting.* TEMPO, SP-255. General Electric Company, Santa Barbara, California, 1964.

A005.0200 Haldi, John. "Criteria for Definition of Program Categories and Program Elements," Bureau of the Budget, Washington, D.C., 1965.

Remarks before the U.S. Naval Post Graduate School, Defense Management Systems Course, Monterey, California, November 9, 1965.

A005.0260 Hofstra, H.J. *New Techniques of Budget Preparation and Management.* International Institute of Administrative Sciences, 1965. General report to the International Congress of Administrative Sciences, 13th, Paris, 1965.

Part II of the discussion deals with several techniques including long-term planning and methods of evaluating costs and benefits.

A005.0300 McCullough, J.D. *Cost Analysis for Planning-Programming-Budgeting Cost-Benefit Studies.* The RAND Corp., Santa Monica, California, November 1966. (DDC No. AD 643-472).

A review of the concepts, principles and the general approach of systems cost analysis in support of cost-benefit studies, prepared for personnel involved in the implementation and operation of the Planning, Programming, and Budgeting System (PPBS) in non-defense agencies.

A005.0440 Quade, E.S. *Systems Analysis Techniques for Planning-Programming-Budgeting.* P-3322. The RAND Corp., Santa Monica, Calif., March 1966.

Discusses the extension of military systems analysis to the civilian activities of the government. Distinctions are drawn between operations research and systems analysis. The process of analysis is described as (1) the objective, (2) the alternatives, (3) the costs, (4) models, and (5) a criterion. A number of techniques for analysis are discussed including mathematical modeling, operational gaming, and scenario writing. The limitations of analysis are described as resulting from incompleteness, the difficulty in measuring effectiveness and uncertainty as to the future.

A005.0540 Stanford Research Institute. *Programming: A Context for Decision-Making in Government and Industry.* Menlo Park, California, SRI, 1965.

Explains the basic philosophy and concepts that underlie this technique and outlines the necessary steps for adapting this system for non-defense purposes.

SYSTEMS ANALYSIS

A200.0050 Carter, Luther J. "Systems Approach: Political Interest Rises," *Science,* Vol. 153 (September 9, 1966), 1222-1224.

A200.0100 Ellis, D.O. and Ludwig, F.J. *Systems Philosophy.* Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1962.

A200.0120 Enthoven, Alain C. *Decision Theory and Systems Analysis.* Lecture sponsored by the Metropolitan Washington Board of Trade, Science Bureau, December 5, 1963. Washington, D.C., Department of Defense, 1964.

A200.0140 Fisher, G.H. *The Analytical Bases of Systems Analysis.* P-3363. The RAND Corp., Santa Monica, Calif., May 1966.

Contains a discussion of the role of analysis in the decision-making process, primarily within the context of long-range planning decisions in the military. The main role of systems analysis in long-range planning is to sharpen judgment. Presented as an example, controlled response strategies, with their increased uncertainties and non-quantitative aspects, make rigorous system analysis infeasible. New concepts, methods and techniques are required to treat complicated issues. To illustrate the role of analysis are discussions of problems in missile forces, military mobility, and water resources.

A200.0160 Flood, M.M. *Overall Viewpoint of Systems Analysis.* Society of Automotive Engineers. Paper 113A for meeting January 11-15, 1960.

Definition of term which is applied to preliminary design studies of very complex man-machine systems: four main steps are: system concepts, feasibility, development monitoring, and evaluation testing; use of techniques is illustrated by example relating to industrial inventory control system design problem; second example makes use of model developed and used by Operations Research Department, University Michigan, for design and evaluation studies of anti-aircraft weapon system.

A200.0200 Grosse, R.N. "Systems Analysis and Management Decision," *Management Views,* Vol. IX (1964), 10-19.

Consists of a discussion of the features of systems analysis and the place of cost estimating in analysis. The objectives of analysis are considered, together with the sequential steps employed in the conduct of a systems analysis. Costing techniques are described with an explanation of incremental costing, cost estimating relationships and the use of the cost categories: R&D, investments, and operating costs. The problem of uncertainty in costing is also discussed.

A200.0210 Hare, Van Court, Jr., *"Systems Analysis," Progress in Operations Research,* Vol. II, ed. David B. Hertz and Roger T. Eddison. New York, John Wiley & Sons, Inc., 1964, p. 123-158.

Discussions concerned with specific problems faced by Operation Research team in applying systems analysis to improvement of specific types of operations includes systems definition, analysis and improvements; simulation and heuristic methods, learning programs, goal and value changes, and system improvement strategies are examined.

A200.0220 Hayes, James H. "Basic Concepts of Systems Analysis," *Military Review,* Vol. 45 (April 1965), 4-13.

Clear explanation of the principles underlying systems analysis.

A200.0240 Hoag, M.W. *An Introduction to Systems Analysis.* RM-1678-PR. The RAND Corp., Santa Monica, Calif., April 1956. (DDC No. AD 101-071).

Describes the nature of systems analysis and its application in problems of military planning. Systems analysis is defined as the systematic examination of problems of choice in which each step of the analysis is made as explicit as possible. Its opposite is intuition. The problem of choice is addressed most importantly to future time periods. A number of constraints which exist in the analysis of current operations do not apply to systems analysis. Systems analysis is concerned with (1) the relevant alternatives, (2) the criteria for choice, (3) the balance of costs and benefits, (4) the structure of the model, (5) the application of the model, and (6) the interpretation of the results.

A200.0260 Holsman, A.J. and Daltch, A.M. *Techniques for Relating Personnel Performance to System Effectiveness Criteria: A Critical Review of the Literature.* Dunlap and Associates, Inc., Santa Monica, Calif., September 1964.

A200.0280 Hoag, Malcolm W. *What is a System?* The RAND Corp., Santa Monica, Calif., 5 March 1957.

The operation or system that is relevant depends upon the problem posed for analysis. An operation or system is a set of interrelated actions about which policy decisions must be made. This research seeks to find a good basis for decisions, using whatever scientific tools are appropriate.

A200.0300 Kahn, Herman and Mann, Irwin. *Techniques of Systems Analysis.* RM-1829-I. The RAND Corp., Santa Monica, Calif., 1957.

A200.0320 Lackner, Michael F. *Digital Simulation and System Theory.* System Development Corp., Santa Monica, Calif., 6 April 1964.

Consideration of the problem of describing dynamic systems and study of digital simulation have led to the identification of a relation describing change, which can be used in conjunction with existing logical and mathematical relations for characterizing systems. In this paper simulation and modeling are discussed and a calculus featuring a change relation is introduced.

A200.0340 Lange, O.R. *Wholes and Parts (System Analysis),* New York, Pergamon Press, 1965.

A200.0360 Lagasse, J.G. "Topological Approach to System Analysis," *Progress in Control Engineering,* Vol. 2, 1-28, n.d.

This expository paper develops several aspects of the structural analysis of signal flow graphs with nodes and branches, according to the techniques of S.J. Mason and C.L. Coates (Procurement Institute of Radio Engineers, New York; Vol. 41, No. 1144, 1953, and CT-6, 170, 1959), respectively. Such graphs are isomorphic with

systems of linear, algebraic equations, permitting the use of many tools from that branch of mathematics. The tutorial paper is strongly oriented toward applications taken from the technology of electrical networks, such as T-bridge circuits, twin inductor dynamos, or parallel voltage regulators. The 15 references cited indicated that it was prepared during 1962, but it makes good reading even at this late date. The author's main point, well-known in engineering circles, is that the topological approach provides a powerful and convenient tool in network system analysis.

A200.0380 Lynch, W.A. and Truxal, J.G. *Introductory System Analysis.* New York, McGraw-Hill, 1961.

A200.0400 Nourse, T.M. "Decision-Making in Systems Engineering," *Instruments and Control Systems,* Vol. 39 (April 1966), 89-95.

A200.0420 O'Keefe, J.K. "Introduction to Systems Analysis," *Journal of Industrial Engineers,* Vol. 15, No. 4 (July-August 1964), 163-167.

Qualitative and quantitative aspects of systems analysis are discussed in terms of stop-by-stop organization of analysis effort; concepts basic to logical accomplishment of systems analysis in industrial engineering are examined in terms of external requirements, sectionalization, and internal systemization; 2 examples are shown of more important conceptual tools, design flow chart and system network diagram.

A200.0440 Peterson, E.L. *Statistical Analysis and Optimization of Systems,* New York, Wiley, 1961.

A200.0460 Quade, E.S. *Some Problems Associated with Systems Analysis.* P-3391. The RAND Corp., Santa Monica, Calif., June 1966.

Discusses the nature and role of systems analysis in decision-making. Systems analysis is described as a method of permitting the judgment and intuition of experts in the relevant fields to be continued systematically and efficiently. The essence of the method is to construct and operate within a model, a simplified representation of the real situation. The model can take many forms, including a set of mathematical equations, a computer simulation, an operational game, or a verbal scenario. The model introduces a structure and terminology that serve primarily as a means of communication to enable participants in a study to exercise their judgment and intuition in a well-defined context.

A200.0480 Sayer, John S. *Do Present Information Services Serve the Engineer?* Auerbach Corp., Philadelphia, Pa. January 1964.

Paper delivered to Engineers Joint Council, January 1964.

A systems engineer looks at the function of engineering as "a production system that can be defined as a 'decision-making enterprise' based on information flow which (1) translates the product of research and development (data and information) into an economical, profitable, and attractive product, and (2) updates and upgrades data and information to improve a design, method, or activity. The engineer is an information processor constantly faced with the problem of effectively and efficiently acquiring and using data and information. This information is of three general types; educational information, information on engineering and experimental methodology, and information for specific problem education.

Present day information services are not serving engineers well because (1) specific information needs of engineers, especially from an overall systems viewpoint, are neither well known nor well understood; (2) activity in the information field has been concentrated on the mechanics of storing and retrieving and not on the utility of the information; (3) few people recognize nor are doing much to solve the problem.

To better serve the engineers' information needs we must first recognize that the man is within the system and the information system must be designed for and around the technical man, not for and around some particular hardware or other concept. The technical man's subjectiveness as both a producer and consumer can neither be denied nor ignored in the design and operation of an efficient and effective information service.

Second, "we must learn to better serve the highly individualistic characteristics of people. We must develop some means for delivering, almost automatically, properly packaged educational, methodological, and specific problem-solution material to the engineer–at his work station–at the time he needs it."

To start building a dynamic system, we need to better define engineers' information needs. A major study is concurrently under way by the Department of Defense, Office of Technical and Scientific Information. "A large volume of pertinent information concerning engineers' information needs is expected to be derived from the study," as well as "Engineers' potential reactions to different package forms and other aspects of information utilization."

Government, universities, technical societies, and industry need to cooperate in this endeavor. Government should "spearhead the dynamic view of information systems . . . because it is the depository for the largest of the information stores . . . It should . . . increase the emphasis placed upon defining and solving the total systems problem and . . . establish definitive research objectives . . . It should resolve the interface and language problems among the various government information services within the government."

Technical societies should continue work on the solution of the language problem, especially the Engineering Thesaurus developed under the direction of Eugene Wall, increase the utility of the Engineering Index and Engineering Library, and institute a needs determination program among technical people. They should also examine the content of their technical journals to improve them as information packages.

Educational institutions should develop a stronger information and literature tradition in engineering graduates; examine the philosophy of the engineering curriculum to increase students' understanding of the acquisition, use, and reporting of data and information; and "accept the responsibility for undertaking basic and meaningful research into the human-to-human communication problem in the technical field."

Industry should expedite its programs to put its own internal information houses in order; determine the specific information its engineers need to solve everyday problems; and integrate technical-information systems into management systems.

A200.0500 Schlesinger, James R. *The Changing Environment for Systems Analysis.* P-3287. The RAND Corp., Santa Monica, Calif., December 1965. (DDC No. AD 479-335).

A200.0520 Spaulding, A.T., Jr. "Is the Total System Concept Practical?" *Systems and Procedures Journal,* Vol. 15 (January 1964), 28-32.

A200.0540 Watkins, H.D. "Socio-Economic Aerospace Market: System Engineering Aids Social Problems," *Aviation Week,* Vol. 84, 52-53+ (January 31, 1966), 79+ (February 7), 1966.

Operations Research

A210.0120 Churchman, C.W., *et al. Introduction to Operations Research.* New York, John Wiley & Sons, 1957.

A210.0240 Firstman, S.I. and Stoller, D.S. "Establishing Objectives, Measures and Criterion for Multiphase Complementary Activities," *Operations Research,* Vol. 14, (January 1966), 84-99.

A210.0360 Hitch, C.J. *Suboptimization in Operations Problems.* P-326. The RAND Corp., Santa Monica, Calif., November 1952.

An analysis of the possibilities, limitations, and dangers of suboptimizing. In addition, the utility of certain concepts and postulates of economic theory for improving the selection of criteria in operations research problems is examined.

A210.0460 Kriebel, Charles H. *On Statistical Cost Analysis and Operation Research.* Pittsburgh, Pa., Carnegie Institute of Technology, Graduate School of Industrial Administration, August 1965.

Although the operations research or management scientist is both a theoretician and an empiricist, the literature on data analysis problems in operations research is relatively sparse. This report discusses a variety of empirical problems in obtaining statistical estimates of operating costs for a quadratic programming model and presents a case history.

A210.0560 McKean, R.N. *Suboptimization Criteria and Operations Research.* P-386. The RAND Corp., Santa Monica, Calif., April 1953.

An extension of the discussion presented in P-326. This paper discusses criteria prerequisite to (1) suboptimizations that lead to improved operations within a given institutional framework, (2) institutional changes devised for increasing efficiency, and (3) descriptive or consumers' research useful to high-level suboptimization.

A210.1000 Sengupta, S.A. and Lackoff, R.L. "Systems Theory from Operations Research Point of View," *IEEE Transactions on Systems Sciences and Cybernetics,* Vol. SSC-1, No. 1, (November 1965), 9-13.

Mathematical representation is developed for normative aspects of systems that are at least partially self-controllable, i.e., adaptive and purposeful; possibility is shown of conflicts in multiple-objective organization, with reduction of ability for acceptable performance toward dominant objective; method is given for measuring interaction among objectives; derivation of measures of inefficiency, effect of structure on inefficiency due to communications and decision making is analyzed; two methods are given for centralized control of "less-than-optimally" structured systems-parameter adjustment, and use of constraints.

R & D Evaluation

A220.0140 Lipetz, Ben-ami. *The Measurement of Efficiency of Scientific Research.* Carlisle, Mass., Intermedia, 1965.

Aims to clarify the meaning of efficiency as applied to scientific research activity and to indicate some specific approaches by which objective efficient measurements might be applied to scientific research for the purpose of improving productivity.

A220.0160 Mitchell, R.S. *On the Theory of Value.* Canadian Armament Research and Development Establishment, Valcartier, Quebec, June 1964. (DDC No. AD 448-078).

The concept of value is considered as it pertains to research and development activities. It is shown that information may be evaluated in the same way as a material object. Distinction is made between evaluating activities in relation to a goal and the evaluation of the goal itself. A formal expression for the latter concept is suggested which might aid in planning activities.

ECONOMICS

A700.0020 Baumol, W.J. *Economic Theory and Operations Analysis.* Englewood Cliffs, N.J., Prentice-Hall, 1961.

Chapter 3, Marginal Analysis, presents the economic basis for cost and resource analysis. The best interests of a firm, a consumer, or any other economic unit require that decisions take into account the magnitude of the marginal yield. The distinction between average and marginal values is explained, and the effects of fixed costs on marginal costs is examined. Accounting data essentially ignore marginal data, which – although difficult to develop – are essential to decision-making. Marginal data are often hypothetical and beyond the range of actual experience. Economies of large scale and diminishing returns are described as the key determinants of the difference between average and marginal costs.

A700.0040 Beesley, M.E. "Mr. Glassborow on Investment Criteria," *Bulletin of the Oxford Institute of Statistics,* May 1961.

A700.0080 Chenery, H.B. "The Application of Investment Criteria, *Quarterly Journal of Economics,* February 1953.

A700.0100 Coase, R.H. "The Marginal Cost Controversy," *Economics,* Vol. 13 (New Series), (November 1946), 169-182.

A700.0110 Davis, Otto A. and Whinston, Andrew B. "Some Notes on Equating Private and Social Cost," *Southern Economic Journal,* Vol. 32 (October 1965), 113-126.

A700.0120 Ellis, Howard S. and Fellner, William. "External Economies and Diseconomies," *American Economic Review,* Vol. 32 (September 1943), 493-511.

A700.0140 English, J.M. and Hasse, R.H. *Economic Selection of Alternative Risk Investments.* P-2869. The RAND Corp., Santa Monica, Calif., 1964.

Develops a technique for making investment decisions in situations involving different levels of risk.

A700.0180 Feldstein, Martin S. "The Derivation of Social Time Preference Rates," *Kyklos,* XVIII, (1965), 277-287.

A700.0200 Feldstein, Martin S. and Flemming, J.S. "The Problem of Time Stream Evaluation: Present Value Versus Internal Rate of Return Rules," *Bulletin of the Oxford Institute of Economics and Statistics,* February 1964.

A700.0210 Glassborow, D.W. "A Comment on Mr. Dawson's Reply," *Bulletin of the Oxford Institute of Statistics,* August 1961.

A700.0220 Hirshleifer, Jack. "Investment Decision under Uncertainty: Applications of the State-Preference Approach," *Quarterly Journal of Economics,* Vol. 80 (May 1966), 252-277.

A700.0240 Hirshleifer, Jack. "Investment Decision under Uncertainty: Choice-theoretic Approach," *Quarterly Journal of Economics,* Vol. 79 (November 1965), 509-536.

A700.0260 Hirshleifer, Jack. "Peak Loads and Efficient Pricing: Comment," *Quarterly Journal of Economics,* Vol. 72, No. 3 (August 1958), 451-468.

In commenting on an earlier article, the author contends that efficient price differences in a peak load situation shown in the earlier work are not discriminatory because they are equal to the differences in the marginal cost of serving the classes of customers involved.

A700.0280 Hirshleifer, Jack. "Peak Loads and Efficient Pricing: A Prior Contribution," *Quarterly Journal of Economics,* Vol. 73, No. 3 (August 1959), 497-498.

This note cites a French paper on peak load pricing for public utilities, which is a thorough and complete analysis of the subject and which was written before the discussions on this topic began appearing in the English language economics literature.

A700.0300 Hirshleifer, Jack. "On the Theory of Optimal Investment Decisions," *Journal of Political Economy,* Vol. 66 (August 1958), 329-352.

Compares the present value and internal rate of return approaches to the problem of arriving at optimal investment decisions.

A700.0310 Howard, R.A. "Bayesian Decision Models for System Engineering," *IEEE Transactions on Systems Science and Cybernetics,* Vol. SSC-1, No. 1 (November 1965), 36-40.

Developments in statistical decision theory are applied to typical systems engineering problems; design of experiment to evaluate reliability parameter for some device and then making decision about whether to accept contract for development and maintenance of system of such devices; concept of subjective probability distribution is introduced to permit encoding prior knowledge about uncertainty in process; decision tree structure is used for establishing optimum size and type of experimentation and for acting on basis of experimental results; approach allows solution of problems that previously could not be formulated.

A700.0340 Leibenstein, H. "Allocative Efficiency vs. X-Efficiency," *American Economic Review,* (Spring 1966), 392-415.

A700.0360 Lewis, W. Arthur. *The Theory of Economic Growth.* London, George Allen and Unwin, 1955.

A basic textbook for the study of economic development. Pays close attention to education as a development factor.

A700.0380 Marglin, Stephen A. "The Social Rate of Discount and the Optimal Rate of Investment," *Quarterly Journal of Economics,* Vol. 77 (February 1963), 95-111.

Considers the question of a social rate of time preference.

A700.0400 Meek, Ronald L. "Ideal and Reality in the Choice between Alternative Techniques," *Oxford Economic Papers,* XVI, (1964), 333-354.

A700.0420 Meek, Ronald L. "A Reply by G.B. Richardson," *Oxford Economic Papers,* XVII, (1965), 291-298.

A700.0440 Paul, M.E. "Covering Costs by Receipts," *Bulletin of the Oxford Institute of Statistics,* November 1960.

A700.0460 Schumpeter, Joseph A. *The Theory of Economic Development.* New York, Oxford University Press, 1961.

An early theoretical approach to the process of economic development which has retained interest in the face of subsequent work. Hence it can be described as a 'classic' in the literature. However, there remains the question of the extent of its applicability elsewhere.

A700.0480 Thomas, Harold A. "The Animal Farm: A Mathematical Model for the Discussion of Social Standards for Control of the Environment," *Quarterly Journal of Economics,* Vol. 77 (February 1963), 143-148.

A700.0490 Tinbergen, J. "Spardefizit und Handelsdefizit," *Weltwirtschaftliches Archiv 95,* (1965) 89.

A700.0500 Turvey, Ralph. "Present Value Versus Internal Rate of Return—An Essay in the Theory of Third Best," *Economic Journal,* Vol. 73 (March, 1963), 92-98.

A700.0520 Wright, J.F. "The Marginal Efficiency of Capital: Corrigendum and Addendum," *Oxford Economic Papers,* November 1964.

A700.0540 Wright, J.F. "Notes on the Marginal Efficiency of Capital," *Oxford Economic Papers*, July 1963.

Systems Analysis - Other

A800.0100 The Carnegie Corporation of New York. *Annual Report.* 1964.

A800.0140 Carnegie Corporation of New York. *Annual Report*, 1966.

This report will be useful to the cost-benefit analyst primarily in that it lists the 1966 activities of the Carnegie Corporation and their justification. The individual analyst will want to use this report for retrieving titles of research reports in areas which he is interested in, obtaining statistics, and the results of experiments and programs.

A800.0300 Fishburn, P.C. *Decision and Value Theory.* New York, John Wiley & Sons, 1964.

Efficient pursuit of objectives and problem of transformation or transition from state of indecision into state of resolution; courses of action and strategies; evaluation of alternate strategies; methods of analysis; theory of reflective and cognitive analysis; measurement of relative values; probability and decision theory.

A800.0420 Geisler, M.A. *Man-Machine Simulation Progress.* P-2086. The RAND Corp., Santa Monica, Calif., 23 August 1960.

This paper discusses a technique which has been largely developed through use in logistics research. The technique has been applied to studies of large logistics management systems in which decision-making under uncertainty is required. The procedure is to build man-machine simulations, and to use them in experimental situations. The output is a description of decision rules, information flows, and an organizational structure that improve the cost and effectiveness of the logistics system. Man is used in these simulations for his learning, adaptiveness, and flexibility.

A800.0560 Gordon, T.J. and Helmer, O. *Report on a Long-Range Forecasting Study.* The RAND Corp., Santa Monica, Calif., September 1964.

This report describes an experimental trend predicting exercise covering a period extending as far as fifty years into the future. The experiment used a sequence of questionnaires to elicit predictions from individual experts in six broad areas: scientific breakthroughs, population growth, automation, space progress, probability and prevention of war, and future weapon systems. Results of the experiment illuminate a number of points: the contents of the predictions themselves, the bases on which respondents claimed their predictions were made, the spread of expert views, the convergence of views following data feedback, the expert's critiques of each other's views, and not least of all, the weaknesses of the method and the possible means for improving it.

A800.0600 Henry, Eugene W., The "Basic Mathematics of Automatic Control," *Disciplines and Techniques of Systems Control.* Waltham, Mass., Blaisdell Pub. Co., p. 39-69.

This chapter provides an introduction to the analysis and synthesis of systems by the state-space approach. A qualitative discussion of differential equations and a short summary of matrix notation and operations are included to provide proper orientation and background for the material in succeeding chapters. The main contents are: Matrix Notation and Operations; Differential Equations; State Space Representation of Systems.

The definitions and explanations are compact, and the examples given are simple but appropriate to explain the relation between the system and its eigenvalues. A brief survey of analytical methods is added, referring to the bibliography. A word of reference to the numerical method to find the transition matrix for the linear process is needed too, since the role of the computer is stressed through this book. The chapter, however, rightly fulfills its role. 14 references.

A800.0700 Hoselitz, Bert F. and Moore, Wilbert E. (eds.). *Industrialization and Society.* Paris, UNESCO, 1963.

A volume of readings on social aspects of the industrialization process, which includes one study specifically dealing with the effects of educational systems on modernization. In addition many of the other studies have relevance for the educational planner.

A800.0800 Lavi, A. "Some Techniques of Optimization," *IEEE Transactions on Communications and Electronics,* (January 1964), 116-120.

A800.0920 Leys, Wayne A.R. *Ethics for Policy Decisions: the Art of Asking Deliberate Questions.* Englewood Cliffs, N.J., Prentice Hall, 1952.

A800.1240 Marglin, Stephen A. *Approaches to Dynamic Investment Planning.* Amsterdam, North Holland Publishing Company, 1963.

The purpose of this book has been two-fold. In part one we attempted to show the inadequacy of a static framework for the planning of durable investment projects and to formulate rules for project planning to maximize the pay-off of investments in a simplified dynamic framework. Chapter 2 analyzed the problem of planning in the absence of budget constraints. Projects were assumed to be indivisible to permit us to focus on the timing problem. In Chapter 3 we turned our attention to projects competing for the funds of a common budget insufficient to undertake all projects at once even if this were desirable. Thus the impact of calendar time on project benefits was at the root of the problems of both chapters of part one. In part two we applied the results of our investigation of dynamic planning in simple models to the planning of water resources development, which was chosen to illustrate the problems introduced by the divisibility of projects because of the extreme durability and complexity of this type of investment. The problem of investment planning subject to budget constraints was posed formally as a problem of maximizing a nonlinear objective (net present value) function subject to multiple linear (budget) constraints – multiple constraints because the results of Chapter 3 obliged us to plan the allocation of present and future investment budgets simultaneously rather than serially. The heart of the problem of finding the constrained maximum lay in that although the objective function could be assumed knowable in the sense of being well-defined, it is costly to learn the value of the function at any given point in its domain of potential budget allocations.

The next item on the agenda was a brief discussion of the relation of planning for one sector, such as the water resources sector, to an overall planning model for a mixed-enterprise economy. Cursory attention was also given the most obvious problems that uncertainty raises for the planning of future investment. The last chapter investiga-

ted investment planning in the presence of increasing returns. We saw that at least one algorithm, the LL algorithm, would operate satisfactorily even if, up to a point, successive dollars of outlay returned progressively more, rather than fewer, dollars of present value. (Author)

A800.1280 Martin, W.W. "Flow Charting: Shorthand, Analysis and Model," *Systems and Procedures Journal,* (March-April 1966), 14-22.

Flow charting serves the systems analyst in three ways: as a shorthand to note precisely the relationships of activities; for studying the efficiency of these relationships; and as a model for simulating and testing new relationships the analyst proposes to establish. This article discusses flow charting for systems people, as opposed to DP logic flow charting.

A800.1360 Masse, Pierre. *Optimal Investment Decisions.* Englewood Cliffs, N.J., Prentice-Hall, Inc., 1962.

A800.1400 Nelson, Edward A. *A Charting Technique for the Analysis of Business Systems.* The RAND Corp., Santa Monica, Calif., May 1965.

This paper describes a charting technique useful in the analysis of business systems and in studies of the information economics of the firm. The decision block charting technique provides a method that (1) Provides a simple concise picture of system elements and relationships, (2) Portrays all pertinent factors, (3) May be used at any desired level of system detail, (4) Helps to structure research in information economics or decision processes, (5) Aids the determination of criteria for system effectiveness. This method may be used to survey and describe an existing system or in planning advanced systems. It is not restricted to any particular kind of business or information system.

A800.2000 Thompson, H.A. *Joint Man/Machine Decisions.* Cleveland, Systems and Procedures Association, 1965.

A800.2500 Tinbergen, J. "Introductory Remarks on the 'Ization Problem'," *Zeitschrift fur die Gesamte Staatswissenschaft,* 119 Band/2 Heft, (April, 1963).

A800.4900 West, Churchman C. *Prediction and Optimal Decision,* Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1961.

The first draft of this book was entitled Cost, Utilities and Values. Now published as one of the Prentice-Hall International Series in Management under its present title, its flavor is best expressed by the subtitle, Philosophical Issues of a Science of Values.

The author believes that fundamental ethical problems underlie the determination of human values. Adequate measurement of values and the science of ethics require basically a science of science, the study of critical decision problems of the scientist . . The basis of judging scientific decisions must be found in an evaluation of the goals of science. The science of science requires the development of empirical methods of ascertaining the relative and ethical importance of goals. The author addresses himself to the meaning of these requirements.

Each of the 16 chapters commences with a summary and statement of the author's intent. Bibliographies for further reading follow most chapters. Even though some occasional items, such as the development of the additivity axiom in the chapter on the additivity of values, are relegated to chapter appendices, the book is not one to recommend lightly to one disinclined to exert himself intellectually. This is the type of book that invites underlining of the many provocative and occasionally pithy passages. No pat solutions are offered. The reader, willing to make the effort of projecting himself into the careful, reasoned discussion in the book, will emerge the richer and more thoughtful for his experience.

A800.5000 Wheeling, R.F. "Optimizers: Their Structure," *Communications for the Association for Computing Machinery,* Vol. 3, No. 12 (December 1960), 632-638.

The paper contains a general discussion of methods of finding the maximum of a function given various ways of obtaining information about the function. Examples are given of a number of situations that can arise.

A800.5100 White Electromagnetics, Inc. *POED – The Answer to Evaluation and Decision Problems.* Technical Bulletin, Vol. 3, No. 1, Bethesda, Maryland, February 1963. (DDC No. AD 400-940).

POED is an evaluation and decision technique which permits computing performance of a device equipment, system, or system complex; compares and scores this performance against requirements, or value judgments representing users' needs and organizes results in a meaningful and useful manner so that rapid assessment of relative and absolute value is practical. It is the basic ingredient for making decisions. POED permits comparing performance of dissimilar or competitive systems against several yardsticks representing different attributes of performance and requirements. It provides the means for determining sensitivity of a system to its elements and assesses the confidence faster of results. Finally, POED provides a synthesis tool for optimizing systems in conceptual design, operational, or retrofit stages.

RESOURCES

General

R000.0020 Amoss, Harold L. and McNickle, Roma K. (eds.). *Land and Water: Planning for Economic Growth.* Third Western Resources Conference. Boulder, Colorado State University, 1961. University of Colorado Press, 1962.

R000.0040 Blomeke, J.O., Perona, J.J., Weeren, H. O. and Bradshaw, R.L. "Evaluation of Ultimate Disposal Methods for Liquid and Solid Radioactive Wastes, Part III," *Interim Storage of Solidified Wastes.* ORNL-3355. Nuclear Science Abstract Number 17: 42416, n.d.

R000.0050 Bowen, Howard R. "The Interpretation of Voting in the Allocation of Resources," *Quarterly Journal of Economics,* Vol. 58 (November 1943), 27-43.

R000.0060 Bowman, M.J. and Haynes, W.W. *Resources and People in East Kentucky.* Baltimore, Johns Hopkins Press, 1963.

An analysis of the problems and potentials of the mountain economy that lays great stress on the human factor. See especially ch. 11-13, written by M.J. Bowman. (M. Blaug)

R000.0080 Brewer, Michael F. "Public Pricing of Natural Resources," *Journal of Farm Economics,* Vol. 44, No. 1 (February 1962), 35-49.

The author contends that an economic analysis, derived from the classical model of a competitive market, fails to provide sufficient insight into public pricing problems to serve as a basis for proposing policy changes. An attempt is made to develop and apply evaluative criteria of a broader type which provide more adequate insight. Range lands and water provide the context for this critique.

R000.0089 Bryk, Oliver. *Aspects of Cost and Utility Analysis in Planning.* Research Analysis Corporation, McLean, Virginia, August 1965. (DDC No. AD 622-114).

Contains a general discussion of decision-making for resource allocation. The primary concern is with the area of economic analysis in which inputs are not commensurate with outputs. Models describing the relationship between inputs and outputs of alternatives are presented, and the submodels are identified as an effectiveness model, a system and organization model, and a cost model. The paper includes mention of the appropriateness of discounting and time-phasing.

R000.0100 Brooks, David B. "Strip Mine Reclamation and Economic Analysis," *Natural Resources Journal,* Vol. 6 (January 1966), 13-44.

R000.0120 Brooks, Harvey. "Science and the Allocation of Resources." Paper delivered at the 1966 annual meeting of the American Political Science Association. New York City, September 6-10, 1966.

This paper stresses the viewpoint that the problem of scientific choice involves simultaneous trade-offs in many different dimensions and not a simple choice between fields of science or of priorities internal to science, as some recent discussions seem to imply.

R000.0140 Ciriacy-Wantrup, S.V. "Benefit-Cost Analysis and Public Resource Development," *Journal of Farm Economics,* Vol. 37, No. 4 (November 1955), 676-689.

The role of benefit-cost analysis in public resource development is discussed. The author covers abuse of benefit-cost analysis; quantifying in benefit-cost analysis; extra market benefits and costs, which include intangibles; and primary (direct) and secondary (indirect) benefits and costs, including secondary benefits stemming from and those induced by a public project.

R000.0160 Ciriacy-Wantrup, S.V. "Conservation and Resource Programming." Paper presented at the symposium, *Programming the Use of Natural Resources.* Annual Meeting of the American Association for the Advancement of Science, Section E, (Geography and Geology), New York, December 30, 1960, p. 105-111. Also in *Land Economics,* Vol. 37 (May 1961), 105-111.

The author states that at first sight, it would appear that the techniques of formal programming would be highly useful for determining the optimum state of conservation. However, there are significant conceptual and operational difficulties that limit the usefulness of quantitative optimizing in the economics of conservation. He discusses these difficulties as three interrelated problem areas; valuation, institutional constraints, and uncertainty, which are present in the programming of all natural resources.

R000.0180 Ciriacy-Wantrup, S.V. *Resource Conservation, Economics and Policies.* Los Angeles, Calif., University of California Press, 1952.

The author states two objectives, the first being to reach agreement as to the meaning of "conservation", as the subject is treated only from the economic and technological standpoints. The second stated objective is the understanding of a given distribution of resource use over time, the study of criteria for the supposed "best" distribution, and the analysis of the economic factors affecting intertemporal distributions. The author feels that his study, while of practical use to resource users and policy makers, also affords an opportunity to test economic theories and methods of analysis for problems relating to time, uncertainty, and social welfare.

R000.0200 Cohee, Melville H. "Economic Evaluation of Soil and Water Management Measures," *Agricultural Engineering,* Vol. 40, No. 12 (December 1959), 740-745.

The author discusses the essentials of economic evaluation of soil conservation. Principles of agricultural economics and farm management must be focused into a solution of the land-use and treatment problems, he says.

R000.0220 Coughlin, Robert E., Keene, John C., Stevens, Benjamin H., and Strong, Ann L. *Private Lands and Public Benefit: Water Resources, Open Space and Urban Growth Management through Land Use Controls.* Philadelphia, Pennsylvania, Institute for Environmental Studies, University of Pennsylvania, March 1967.

A report on an experiment in progress to evaluate the costs and benefits of alternate ways of managing land use under various legal controls.

R000.0240 Crutchfield, James A. "Valuation of Fishery Resources," *Land Economics,* Vol. 38 (May 1962), 145-154.

R000.0260 Fisher, G.H. *What is Resource Analysis?* P-2688. The RAND Corp., Santa Monica, Calif., January 1963. (DDC No. AD 294-994).

This paper discusses the nature and need for resource analysis. The meaning and application of resource analysis can vary, depending on the problem at hand. Problems can vary according to the time horizon, the decision context (for R & D, investment or operations), or the involvement of the total force or individual systems. The major characteristics of a resource analysis capability designed to serve a long-range planning activity are (1) end-product orientation, (2) life-cycle identification, (3) resource and functional categories, (4) appropriate level of detail, (5) explicit treatment of uncertainty, (6) incremental resource impact, (7) identification of support with end-products, (8) levels of accuracy, (9) time-phasing and (10) data and estimating relationships.

R000.0280 Hague, A. Bartlett, Jr. "Resolving Conflicts in Natural Resource Allocation," *Journal of Soil and Water Conservation,* Vol. 19, No. 4 (November-December 1964), 241-244.

This article outlines a planning-political framework for precise statement and evaluation of conflicting preservation and development objectives in natural resource allocation. The ultimate objective is to achieve just allocation of natural resources among conflicting uses and users.

R000.0300 Hirsch, W.Z. *Program Budget for Natural Resources Activities.* RM-4513 RC. The RAND Corp., Santa Monica, Calif., June 1965.

This memorandum discusses the application of program budgeting to natural resources activities of the Federal Government, the objectives of these activities, their treatment in the present budget, and proposals for a natural resources program budget. Administrative and institutional arrangements for effective decision-making in the allocation of natural resources are discussed.

R000.0320 Hirsch, Werner Z., "Program Budget for Natural Resource Activities," in *Program Budgeting, Program Analysis and the Federal Budget,* ed. by David Novick. Cambridge, Massachusetts, Harvard University Press, 1965. p. 248-284.

There are many demands on Federal funds, and since we have limited natural resources that must be put to a variety of uses, the Federal government faces some difficult choices. Improved tools are needed to articulate these choices and to facilitate judicious decisions, the author declares.

He stresses the need for a carefully defined national resources policy. No such policy statement can be readily found, he says. Admittedly the quantity and diversity of public and private bodies involved in natural resources activities complicate the process of fashioning comprehensive and coherent natural resource programs. But the key question 'Should less be devoted to A, more to B?' can be approached much more precisely.

The chapter is divided into four parts: (1) an examination of assumptions and objectives of our national resources policy; (2) a review of existing budget activity and suggested ways of bringing it closer to a program budget; (3) a presentation of how program budgeting can elucidate allocation decisions; (4) a consideration of administrative and institutional arrangements needed to implement decisions.

R000.0340 International Institute for Land Reclamation and Improvement. *An Assessment of Investments in Land Reclamation,* 1960.

R000.0350 Kantorovich, Leonid V. *The Best Use of Economic Resources.* Cambridge, Harvard University Press, 1965.

Sums up the extensive researches of the author, a member of the Academy of Sciences of the U.S.S.R., in developing methods of linear programming which can be used for quantitative analysis of economic questions--providing proofs and illustrations in the solution of specific technical-economic and planning problems especially concerned with evaluation of alternative allocation of factors of production.

R000.0355 Melman, Seymour. *Our Depleted Society.* New York, Dell Publishing Co., Inc., 1965.

The first part of this book presents statistics to prove that our military budget is excessive and has been responsible for depleting certain of our resources. The second half of the book discusses ways that the military budget could be reduced while still providing adequate defenses and ways in which the savings could be allocated to health, education, and welfare and be used to stimulate the economy. Greater economic growth would be achieved by subsidizing industries that an excessive emphasis on military needs has depleted.

R000.0360 Michelson, Irving and Tourin, Boris. "Comparative Method for Studying Costs of Air Pollution," *Public Health Reports,* Vol. 81 (June 1966), 505-511.

Reports the methodology of a 1960 study of air pollution costs in the Upper Ohio Valley.

R000.0380 Munby, K.L. "Investing in Coal," *Oxford Economic Papers,* 1959.

R000.0399 "National Academy of Sciences Tries Systems Analysis on Pollution," *Chemical and Engineering News,* Vol. 44, No. 25 (April 11, 1966).

R000.0400 Novick, David. *Resource Analysis in Military Long-Range Planning.* P-2861. The RAND Corporation, Calif., February 1964.

An explanation of three terms (program budgeting, cost effectiveness, and cost analysis) introduced by the office of the Secretary of Defense in 1961. The purpose of the paper is to facilitate communications between the Department of Defense, military departments, military contractors, and the business community by clarifying the terms.

R000.0420 Ogden, Delbert C. "Economic Analysis of Air Pollution," *Land Economics,* Vol. 42 (May 1966) 137-147.

Develops a model approximating the total cost of air pollution and the cost of specific pollutants to an air shed.

R000.0440 U.S. President's Materials Policy Commission. *Resources for Freedom.* Washington, D.C., June 1952.

R000.0460 Renshaw, Edward F. "Atomic Power: Research Costs and Social Returns," *Land Economics,* Vol. 35 (August 1959) 222-231.

Holds that it is possible to estimate not only the ex post returns from public and private investment in research but also to make ex ante estimates of returns from research not yet completed.

R000.0480 Resources for Tomorrow, Inc. *Resources for Tomorrow Conference.* Montreal, 1961.

Benefit-cost Analysis and Project Evaluation, by R.A. Spargo, Vol. 1, p. 299-310; Water Workshop B, Benefit-cost Analysis, Vol. 3, p. 145-159.

R000.0500 Ridker, Ronald G. *Economic Costs of Air Pollution; Studies in Measurement.* New York, Frederick A. Praeger, 1966.

Investigates the costs of air pollution by reducing all costs to dollar costs. Chapter 5 includes a case study of a pollution episode, with a study of psychological reactions in the area. This book could be used as a standard text on the effects of air pollution.

R000.0520 Scott, Anthony. *Natural Resources: The Economics of Conservation.* Toronto, Canada, University of Toronto, 1955.

R000.0540 Smith, E.E., and Wright, J.H. "Future Energy Needs and Nuclear Fuel Use," *Atomics,* Vol. 18 (May-June 1965), 22-26.

R000.0560 Timmons, John F. "Land and Water Resource Policy," *Journal of Farm Economics,* Vol. 45, No. 1 (February 1963), 95-108.

This article reviews "Land and Water Resources: A Policy Guide," USDA, Washington, D.C., May 1962. The author discusses the report's strengths and limitations and points out relevant considerations not treated in the report.

R000.0580 Ullman, John E., "Economics of Nuclear Power," *Advances in Nuclear Science, Vol. 1 – 1962,* ed. Ernest J. Henley and Herbert Kouts. New York, Academic Press, Inc., 1962.

R000.0600 U.S. Department of Agriculture. *Economic Evaluation of Use of Soil Conservation and Improvement Practices in Western Iowa,* Washington, D.C., 1957.

R000.0620 U.S. National Resources Board. *A Report on National Planning and Public Works in Relation to Natural Resources and Including Land Use and Water Resources with Findings and Recommendations.* Washington, D.C., December 1, 1934.

R000.0640 Garnsey, Morris E. (ed.) *New Horizons for Resources Research: Issues and Methodology.* Sixth Western Resources Conference, 1964. Boulder, Colorado, University of Colorado Press, 1965.

The demand-value structure of recreation, by Lionel J. Lerner, p. 21-27; Use of systems analysis in estaurine water pollution control, by Robert V. Thomann, p. 47-59; Systems analysis approach to water quality prediction in a complex river basin, by J.L. Worley and F.J. Burgess, p. 61-86.

R000.0650 Wise, Harold F., "Planning, Programming, Budgeting Systems and the Planning Role," in *Extension of Remarks of Honorable Hugh Scott, Congressional Record,* Vol. 113 (February 15, 1967), S1975-S1978.

The paper reviews the demands which are being placed on the planner and budgeter today, and discusses the contribution which PPBS is making as it assists management in determining how, when, and where to allocate precious resources. A brief discussion of the State and Local Finances Project, the so-called '5-5-5-Project,' is followed by commentary on the difference between traditional urban planning and the PPBS 'Multi-year broad, functional-area program statements' for a period of one to five years.

Mr. Wise states that what is really needed is a combination of PPBS and 'comprehensive (i.e., long range, all-inclusive) planning.' A recommendation is made for a viable planning program which has four levels of output, considered in terms of detail, generality, time scale, and particularity. The four elements would be:

1. A comprehensive Development Policies Plan (a broad statement of direction).
2. A series of functional plans, crossing program and often department lines, and developed at the State level.
3. A program plan for each program within the galaxy of activities of the affected level of government.
4. An annual development plan, where PPBS would be applied.

R000.0660 Wolozin, Harold, (ed). *The Economics of Air Pollution, A Symposium.* New York, Norton, 1966.

Partial Contents.–Air pollution–general background, by Allen V. Kneese.–Economic incentives in air pollution control, by Edwin S. Mills.–Strategies for measuring the cost of air pollution, by Ronald G. Ridker.–The use of Government statistics in air pollution control, by Edward T. Crowder.–Setting criteria for public expenditures on air-pollution abatement: theoretical foundations and limitations, by Harold Wolozin.

R000.0655 Wolff, P. and Middelhock. "Price Policy for Natural Gas Deposits," *Econometrica,* Vol. 34, No. 5 (1966), 48-49.

Manpower in the United States

R100.0020 Aukrust, O. "Investment and Economic Growth," *Productivity Measurement Review,* (February 1959), 35-53; "Some Comments" by R.M. Solow, *Ibid.* (November, 1959), 62-68. Reprinted in *Readings on Education and Economic Development.* (eds.). M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey, Paris, UNESCO, 1964.

After examining the implications of the constant capital-output-ratio approach to economic growth, the author pleads for more attention to 'the human factor,' i.e., organization, professional skills, and technical knowledge, illustrated with reference to an empirical study for Norway. Solow comments on the implications of Aukrust's remarks. (M. Blaug)

R100.0030 Correa, Hector. *Economica de los Recursos Humanos.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R100.0050 International Labor Organization. *International Standard Classification of Occupations.* Geneva, International Labour Office, 1949.

A discussion of some of the problems involved in making such a classification precedes the analysis of the classification, which may be compared with that used in the OECD Mediterranean Regional Project.

R100.0060 Isaac, J.E. "Manpower Planning in Australia," *International Labour Review,* Vol. LXXXII, No. 5 (November 1960), 403-431. Also published in French and Spanish.

A description of the machinery used to preserve full employment in a little-developed country with an expanding labour force, and some issues involved in carrying out such activities in a predominantly private-enterprise economy. There is little mention of any related educational planning.

R100.0090 Scott, Norman, "Towards a Framework for Analyzing the Costs and Benefits of Labour Migration," *International Institute for Labour Studies Bulletin,* No. 2, February 1967.

Theory of Investing in Manpower

R110.0020 Becker, G.S. "Investment in Human Capital: A Theoretical Analysis," *Journal of Political Economy,* Supplement, (October 1962) 9-50. Excerpts reprinted in *Readings on Education and Economic Development,* (ed.). M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964. "A Comment"

by R.S. Eckaus, *Journal of Political Economy,* October 1963, and "A Reply", by G.S. Becker, *Ibid.,* October 1964.

The argument proceeds from a discussion of specific kinds of human capital, with particular attention to on-the-job training, to a general theory applying to any kind of human capital. A fundamental article, full of original insights. Eckaus' comments point out the special assumptions in Becker's argument. (M. Blaug)

R110.0030 Bonner, J. and Lees, D.S. "Consumption and Investment," *Journal of Political Economy,* (February 1963), 64-76.

An effective defense of the concept of human capital. The issue rests essentially on the view taken of the productive process: in the Marshall-Pigou view of 'final output' and the Keynesian view of national income, investment of any kind appears to be somewhat inconsistently included. It is argued that the idea of human capital implies a closed input-output model of the economy. (M. Blaug)

R110.0040 Bright, J.R. "Does Automation Raise Skill Requirements," *Harvard Business Review* (July-August 1958), 85-97. Reprinted in *Perspectives on the Economics of Education. Readings in School Finance and Management,* ed. C.S. Benson. Boston, Houghton Mifflin, 1963, p. 66-81.

Based on a close study of 13 plants, this article denies the popular belief that automation necessarily results in an upgrading of work-force skill requirements. As the author shows, automation of an enterprise often tends to reduce the skill and training required of the work force in that enterprise. (M. Blaug)

R110.0060 Bombach, G. and Riese, H. *Qualified Manpower and Economic Growth.* Thirty-fifth Session of the International Statistical Institute, Belgrade, Yugoslavia, 1965.

R110.0080 Boulding, K., "An Economist's View of the Manpower Concept," National Manpower Council, *Proceedings of a Conference on the Utilization of Scientific and Professional Manpower.* October 7-11, 1953. New York, Columbia University Press, 1954, p. 11-33.

"I find the whole manpower concept repulsive, disgusting, dangerous, facistic, communistic, incompatible with the ideals of a liberal democracy, and unsuitable company for the minds of the young." After a precis of the classic theory of human resource allocation a la Adam Smith modified by Pigou, Boulding concedes that some government interference may be in order. MacIver summarizes the Conference's discussion of Boulding's paper. The rest of this volume includes specialized papers on manpower planning in engineering, medicine and teaching. (M. Blaug)

R110.0100 Bowman, M.J., "The Costing of Human Resource Development," *International Economic Association Conference on the Economics of Education.* London, Macmillan, 1965. Excerpts reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

A convincing defense of the practice of including foregone earnings in assessing the 'real cost' of both formal and informal education. (M. Blaug)

R110.0118 Harbison, F.H. *Evaluacion de Recursos Humanos.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R110.0120 Bowman, M.J., "Human Capital: Concepts and Measures," *Economics of Higher Education,* ed. S.J. Mushkin. Washington, D.C., Government Printing Office, 1962, p. 69-93. Reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey, Paris, UNESCO, 1964.

A technical discussion of measurement problems in the area of human capital formation. (M. Blaug)

R110.0140 Carter, C.F. "The Economic Use of Brains," *Economic Journal,* (March 1962), 1-12.

A plea for research into the factors affecting the supply of high ability and its distribution between occupations. The author concludes that 'we need further evidence before it will be safe to suppose that there is plenty of high ability available, at present running to waste, and easily conserved'. (M. Blaug)

R110.0160 Debeauvais, M. "The Concept of Human Capital," *International Social Science Journal,* Vol. XIV, No. 4 (1962), 660-676.

An attempt to place the concept in the mainstream of economic thought. (M. Blaug)

R110.0180 Ginzberg, E. *Human Resources: The Wealth of a Nation.* New York, Simon & Schuster, 1958.

A short popular book based on the research that has been conducted by the Conservation of Human Resources Project since 1950. Particular attention is given to wastes of human resources due to unemployment, inadequate training, and sex and race discrimination. A bibliography is included. (M. Blaug)

R110.0200 Grubel, H.B. and Scott, A.D. "The International Flow of Human Capital," *American Economic Review,* (May 1966), 268-275.

Some preliminary results of a forthcoming study on the U.S. balance of trade in human capital from foreign student exchange and the immigration of scientists and engineers, followed by a theoretical re-assessment of the 'brain drain' argument. But see B.A. Weisbrod's comments, *Ibid.,* pp. 277-280. (M. Blaug)

R110.0220 Harbison, F.H. and Myers, C.A. *Management in the Industrial World. An International Analysis.* New York, McGraw-Hill, 1959.

The chapter on 'The Development of Managerial Resources' is directly concerned with the role of education in creating high-talent manpower, but the twelve country studies in this book also touch repeatedly on this theme. (M. Blaug)

R110.0240 Hufner, K. "The History in/sic/the Measurement of Human Capital." (Mimeographed.) *Max-Planck-Institute for Educational Research,* Berlin, 1966.

A history of the concept of human capital, drawing attention to a number of neglected German and French authors. (M. Blaug)

R110.0250 Johnson, H.G. "Towards a Generalized Capital Accumulation Approach for Economic Development," *The Residual Factor and Economic Growth.* J. Vaizey. Paris, Organization for Economic Cooperation and Development, 1964.

A clarifying Fisherian generalization of the human-capital approach. (M. Blaug)

R110.0260 Keesing, D.B. "Labor Skills and Comparative Advantage," *American Economic Review,* (May 1966) 249-259.

An attempt to demonstrate that skill differences between countries constitute a persistent source of differences in comparative advantage and hence, of observed trade patterns. But see H.G. Johnson's comments, *Ibid.,* 280-282. (M. Blaug)

R110.0270 Kerr, C., Dunlop, J.T., Harbison, F.H. and Myers, C.A. *Industrialism and Industrial Man. The Problems of Labor and Management in Economic Growth.* London, Heinemann, 1962.

An attempt to present a systematic discussion of labor economics in a historical perspective. The four authors touch repeatedly on education as a factor both in the formation of an industrial work force and guiding elite dedicated to modernization (see particularly pp. 36-39, 118-119, 286-287). For a precis of the argument by the authors, see *International Labor Review,* March 1955, pp. 223-236. (M. Blaug)

R110.0275 Kiker, B.F. "The Historical Roots of the Concept of Human Capital," *Journal of Political Economy,* (October 1966), 481-500.

An excellent history of the concept, tracing it back to Petty in the eighteenth century. (M. Blaug)

R110.0280 Mincer, J. "Investment in Human Capital and Income Distribution," *Journal of Political Economy,* (August 1958), 281-300.

Discarding stochastic explanations of income distribution, the author develops a model which makes interoccupational differentials in earning a function of differences in training. He shows that such a model accounts for a number of observed empirical regularities in income distribution. (M. Blaug)

R110.0300 Moore, Wilbert E. *Industrialization and Labour.* Ithaca, New York, Cornell University Press, 1951.

The author examines the effects of economic development on the quantitative and qualitative supply of labour. This education is of importance, especially in the light of the sociological approach adopted.

R110.0314 National Bureau of Economic Research. *The Comparative Study of Economic Growth and Structure. Suggestions on Research Objectives and Organization.* New York, National Bureau of Economic Research, 1959.

In Ch. 5, 'A Catalog of Problems', see 'Human Resources and Attitudes', pp. 45-47 for suggestions of research topics in the area of human resource development. (M. Blaug)

R110.0320 Nelson, R.R. and Phelps, E.S. "Investment in Humans, Technological Diffusion, and Economic Growth," *American Economic Review,* (May 1966) 69-76.

A model of economic growth based on the assumption that education promotes growth, not by augmenting the productive capacity of the labor force, but by accelerating the rate at which entrepreneurs adopt the best-practice technology. (M. Blaug)

R110.0340 Platt, William J. "Individuals: Neglected Elements in Economic Development Planning," *International Development Review,* Vol. V, No. 3 (September 1963), 16-20.

The concern of the article is to point out that in the last analysis planning is for the greater well-being of individuals. Hence its success requires that the planner keep this in mind to secure their cooperation. The examples given derive from economic planning, but relevant ones can also be found for educational planning.

R110.0360 Schaeffer, H. "Investment in Human Capital: Comment," *American Economic Review,* (December 1961), 1026-1035. "Reply" by T.W. Schultz, *Ibid.,* 1035-1039.

A consistent attack on the concept of human capital on theoretical and practical grounds with a vigorous reply by Schultz. (M. Blaug)

R110.0380 Schultz, T.W. "Investment in Human Capital," *American Economic Review,* (March 1961), 1-17. Excerpts reprinted in *Perspectives on the Economics of Education. Readings in School Finance and Management,* ed. C.S. Benson. Boston, Houghton Mifflin, 1963, p. 12-20.

An authoritative statement of the concept of human capital which makes a strong case for investigating the returns to investment in human beings. (M. Blaug)

R110.0400 Schultz, T.W. "Investment in Man: An Economist's View," *Social Service Review,* (June 1959), 109-117. Reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey. Paris, UNESCO, 1964.

An early statement by the 'father' of the concept of human capital. (M. Blaug)

R110.0420 Schultz, T.W. "Investing in Poor People," *American Economic Review* (May 1965), 510-520.

A discussion of the poverty problem from the standpoint of human capital formation. (M. Blaug)

R110.0440 Thonstad, Tore. "Zimensjonering av skilesystement etter benouet for utdanne arbeidskraft," *Saetrykk av Statsokonomisk Tidsskrift,* No. 2, 1964.

R110.0450 Universities-National Bureau Committee for Economic Research, *Investment in Human Beings.* Papers presented before the Exploratory Conference on Capital Investment in Human Beings held at the Carnegie Endowment International Center, New York, 1961. Chicago, University of

Chicago Press, 1962. *Journal of Political Economy*, No. 5, Pt. 2, Supp. (October, 1962).

Investment in Human Capital: A Theoretical Analysis, by Gary S. Becker, p. 9-49; Education and Investment in Human Capital, by Burton A. Weisbrod, p. 106-123; Health as an Investment, by Selma J. Mushkin, p. 129-157.

R110.0460 Weisbrod, B.A. "Investing in Human Capital," *Journal of Human Resources*, (Summer 1966), 5-22.

A broad survey of American findings on investment in health and education with particular attention to some of the author's own work on the external benefits of education. (M. Blaug)

R110.0480 Weisbrod, B.A. "The Valuation of Human Capital," *Journal of Political Economy*, (October 1961), 425-437.

Estimates the capital value – the net future productivity discounted at 3% and 10% – of U.S. males at various ages and concludes with a figure for 1960 far in excess of the value of physical capital. The article closes with a discussion of the significance of such estimates for public spending policies. (M. Blaug)

Planning for Manpower

R120.0020 Barbichon, Guy. *Adaptation and Training of Rural Workers for Industrial Work.* Paris, Organization for Economic Cooperation and Development, December 1962.

Theoretical problem of change–First results of research on the movement of agricultural manpower to industrial work and methods of research on the adaptation–Lessons and practical suggestions–Mobility of rural manpower in relation to economic growth–Current bibliographical references.

R120.0040 Beijer, G. *National Rural Manpower. Adjustment to Industry.* Paris, Organization for Economic Cooperation and Development, August 1965.

Reviews the theoretical and practical aspects of social and vocational adjustment of rural manpower to industrial and urban life. Presents policies and techniques for facilitating adjustment of rural workers to non-agricultural occupations and concludes with recommendations dealing with matters such as communication, information and guidance, preparation at school, training and retraining, wives and younger single girls, social welfare and expenditure, housing and social infra-structure, leisure activities.

R120.0060 Blum, J. *A Study of Skill Acquisition and Development.* Paris, Organization for Economic Cooperation and Development, 1965.

The national M.R.P. reports generally neglected different sources of skill development other than the formal educational system. This preliminary methodological paper, however, focuses on the informal sources: adult education programmes, apprenticeship-training programmes, and on-the-job training schemes. It reviews some of the latest empirical evidence from the United States on methods of skill acquisition, spells out the implications of these findings for educational planning, maps out research projects in the M.R.P. countries, and concludes with a questionnaire that was used in Spain to obtain necessary data on vocational training. (M. Blaug)

R120.0080 Borus, Michael E. "A Benefit-Cost Analysis of the Economic Effectiveness of Retraining the Unemployed," *Yale Economic Essays*, Vol. 4 (Fall 1964), 371-429.

R120.0100 Burtle, J. "Input-Output Analysis as an Aid to Manpower Policy," *International Labor Review* (May 1952), 600-626.

An excellent brief primer in input-output analysis with a discussion of its application to manpower planning. (M. Blaug)

R120.0120 Davis, Russell. *Planning Human Resource Development: Models and Schemata.* Chicago, Rand-McNally, 1966.

R120.0140 Gray, D.H. *Manpower Planning. An Approach to the Problem.* London, Institute of Personnel Management, 1966.

What this pamphlet is about is manpower planning in the individual enterprise. It has no relevance, therefore, to educational planning or policy-making. (M. Blaug)

R120.0160 Griew, Stephen. *Job Re-Design.* Paris, Organization for Economic Cooperation and Development, August 1964.

The report brings to light methods of removing the stresses and strains where they could be deleterious, in order to extend the employment potential for older people, thereby assuring longer work-life span.

R120.0180 Harris, S.E., "More Information on Investments in Human Capital," *The Residual Factor and Economic Growth*, ed. J. Vaizey. Paris, Organization for Economic Cooperation and Development, 1964.

Despite its title, this paper deals mostly with unsettled questions in manpower planning but, along the way, it touches on a number of other unsettled questions in the economics of education. (M. Blaug)

R120.0200 Horowitz, M.A., *et al. Manpower Requirements for Planning. An International Comparison.* Boston, Mass., Department of Economics, Northeastern University, 1966.

Data from 19 countries on the occupational composition of the labor force, cross-classified by industry and by educational attainments, and ranked by output per head. Linear regression analysis showed that the occupational structure of an industry is related to the productivity of labor in that industry, both between states in the United States and between countries around the world. Vol. 1, Chap. 5, pp. 39-47, presents a step-by-step description of the use of the data for purposes of projecting manpower requirements. (M. Blaug)

R120.0220 Industrial Relations Research Association. *Manpower and Welfare Programs: Benefit-Cost Analysis.* Proceedings of the 17th Annual Meeting. Chicago, December 28-29, 1964. Madison, Wisconsin, IRRA, 1965.

Contents.–Benefit-cost analysis of manpower retraining, by Gerald G. Somers and Ernst Stromsdorfer.–Benefit-cost analysis of welfare programs, by John S. MacDonald.–Capital-output analysis of housing programs for developing nations, by Leland Burns.–Discussion, by Juanita Kreps, Selma Mushkin, and Benson Soffer.

R120.0229 International Labor Organization. *Some Aspects of the Role of Manpower Planning in Economic Planning.* Paris, UNESCO, 18 June 1963.

The paper outlines some main characteristics of manpower and planning associated with it, and then discusses the integration of manpower planning into overall economic planning.

R120.0240 Krier, H. *Rural Manpower and Industrial Development. Adaptation and Training.* Paris, Organization for Economic Cooperation and Development, August 1961.

This survey on National reports of six countries (France, Germany, Italy, Netherlands, Sweden and Yugoslavia), describes the problem in those countries: the conditions and circumstances in which rural workers are recruited and trained by industry, the measures taken and the results observed; enables employers of rural manpower and local representatives of trade unions to examine jointly the problems which industry has to face when taking on rural manpower.

R120.0260 Lester, R.A. *Manpower Planning in a Free Society.* Princeton, N.J., Princeton University Press, 1966.

This book is aimed primarily at improving manpower planning and manpower policies in the United States, setting forth a programme of action designed to realize the purposes of Title I of the Manpower Development and Training Act of 1962. It includes, however, useful comparisons with Europe, as, for example, in Chapter Three on 'A New Concept of the Employment Service', pp. 45-85. See also the discussion on cost/benefit analysis of training schemes, Chapter 7, pp. 172-192. (M. Blaug)

R120.0280 Organization for Economic Cooperation and Development, Manpower and Social Affairs Directorate, Social Affairs Division. *Active Manpower Policy. The Final Report and Supplement to the Final Report of the International Management Seminar on Active Manpower Policy, Brussels, 14-17 April 1964.* Paris OECD, 1965.

The Final Report consists of 2 essays prepared for the seminar (W.E. Bakke, 'An Active and Positive Manpower Policy,' pp. 127-143, and L. Aarvig, 'Active Manpower Policy, The Attitude and Role of Employers and Their Organizations,' pp. 145-156) and a text which weaves together the material from the country-studies in the *Supplement.* By an 'active manpower policy' is meant the integrated provision by the public authorities of local employment exchanges, occupational counselling services, manpower forecasting information, public works programmes in depressed areas, vocational training and retraining schemes, and a system of unemployment compensation and relocation payments. (M. Blaug)

R120.0300 Organization for Economic Cooperation and Development. *Resources of Scientific and Technical Personnel in the O.E.C.D. Area. Statistical Report of the Third International Survey on the Demand for and Supply of Scientific and Technical Personnel.* Paris, OECD, 1964.

The objectives of this survey were to determine the changes in the employment prospects of scientists and technicians in the various sectors of the economies of member countries since the second O.E.C.D. survey in 1956. A wealth of data is presented for individual countries like the whole of Western Europe contrasted with Canada and the U.S.A., and for small and large developed countries contrasted with developing countries. For the most part the figures are allowed to speak for themselves without any serious attempt at interpretation. This study exemplifies once again the need for more internationally comparable data. (M. Blaug)

R120.0320 Sinha, M.R. (ed.). *The Economics of Manpower Planning.* Bombay, India, Asian Studies Press, 1965.

All of the seven essays in this volume have previously appeared in *International Labor Review.* (M. Blaug)

Manpower Planning for the U.S.

R121.0010 Clark, H.F. *Life Earnings in Selected Occupations in the United States.* New York, Harper and Bros., 1937.

This study, based on data for the period 1920 to 1936, makes interesting reading in the light of recent interest in rate-of-return analysis. The findings are conveniently summarized in Ch. 1. Ch. 2 emphasizes the need for better information regarding lifetime earnings. This book probably influenced the American decision to begin asking earnings data in the 1939 census. (M. Blaug)

R121.0020 Colberg, M.R. *Human Capital in Southern Development 1939-1963.* Chapel Hill, North Carolina, University of North Carolina Press, 1965.

An important work that calculates changes in the South's college-educated human capital as a share of all human capital in the United States since 1939 in order to deduce the amount of migration of human capital that has taken place. Along the way, there are interesting discussions of the determination of teachers' salaries in the South and income-education differentials in the South and in the North. (M. Blaug)

R121.0030 Gilman, H.J. "Economic Discrimination and Unemployment," *American Economic Review,* (December 1965), 1077-1097.

This paper tests the hypotheses that the greater unemployment rate of American non-white males over white males is due, not just to discriminatory treatment in hiring and firing, but to the occupational and educational characteristics of non-white workers. It turns out that occupation does indeed account for almost half of the differential unemployment rates in the 1950's but that differences in educational attainment as such have little impact on the differential. (M. Blaug)

R121.0040 Hansen, W. Lee., "'Shortages' and Investment in Health Manpower," *The Economics of Health and Medical Care.* May 1962. Ann Arbor, Michigan, The University of Michigan, 1965, p. 75-92.

One of the first articles to use rate-of-return evidence to throw light on shortages of qualified manpower, in this case, physicians and dentists in the United States. The author compares the rates of return of physicians and dentists with those of all male college graduates between

1939 and 1956, showing that the shortage of doctors and dentists has declined since 1949. (M. Blaug)

R121.0060 Hills, S.E. and Harbison, F.H. *Manpower and Innovation in American Industry.* Princeton, N.J., Princeton University Press. Industrial Relations Section, Research Report No. 97, 1959. Excerpts reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey, Paris, UNESCO, 1964.

Presents a simple model showing that growth at one level of education entails accelerated growth at all higher levels (via the number of teachers produced by higher levels) and tests this notion with the aid of India data. In the closing section of the article, the authors integrate the national education budget with the national capital investment budget in a planning model that underlies India's Five Year Plans. (M. Blaug)

R121.0080 Hoos, I.R. "Retraining in the United States: Problems and Progress," *International Labor Review* (November 1965), 410-426.

This article describes some of the general issues that were raised in an ongoing research project on American retraining programmes. Four case studies of training courses, provided respectively by the Federal Government, a private firm, a trade union, and a state employment office under the Manpower Development and Training Act, are provided by way of illustration. (M. Blaug)

R121.0100 Mangum, G.L. (ed.). *The Manpower Revolution: Its Policy Consequences. Excerpts from Senate Hearings Before the Clark Subcommittee.* New York, Anchor Books, Doubleday & Co., 1966.

The Senate Subcommittee on Employment and Manpower of the Committee on Labor and Public Welfare, under the chairmanship of Senator J.S. Clark, conducted hearings in 1963 and 1964 'Relating to the Training and Utilization of the Manpower Resources of the Nation.' This volume reprints excerpts of the record of these hearings, published originally in ten parts under the general title, *The Nation's Manpower Revolution.* It provides an excellent introduction to recent American debates on structural unemployment, the impact of automation, the war on poverty, and the concept of 'an active manpower policy.' The articles most relevant to our purpose are: H. Goldstein, 'Projections of the Labor Force of the United States,' pp. 15-33; C.C. Killingsworth, 'Automation, Jobs and Manpower: The Case for Structural Unemployment,' pp. 97-117; W.W. Heller, 'The Case for Aggregate Demand,' pp. 117-147; Subcommittee Findings, 'The Manpower Revolution,' pp. 235-267; W.H. Miernyk, 'British and Western European Labor Market Policies,' pp. 359-371; C.G. Uhr, 'Manpower Revolution: Questions Submitted to the Department of Health, Education, and Welfare,' pp. 382-395; and lastly, a statement of the Subcommittee's majority policy recommendations, pp. 451-553. (M. Blaug)

R121.0110 Keat, P.G. "Long-Run Changes in Occupational Wage Structure, 1900-1956," *Journal of Political Economy* (December 1960), 584-600.

An attempt to explain the decline in relative skill differentials over the last fifty years. After reviewing a number of factors, the author concludes that changes in the cost and time of education and training account for a large part of the narrowing of wage differentials. (M. Blaug)

R121.0117 United States, Agency for International Development. *Seminar on Problems of Manpower Planning, Development, Utilization, Distribution and Administration.* Washington, D.C., U.S. Government, 1962.

The record of the lectures and discussions which took place during the seminar. Education receives little direct mention except in relation to urban skill acquisition, but there is much discussion of methodological aspects of planning.

R121.0118 United States, Agency for International Development. *Seminar on Problems of Manpower Planning Development, Utilization, Distribution and Administration.* Washington, D.C., U.S. Government, 1963.

The 1963 seminar differed from the previous year's in concentrating more on the relation between manpower and economic development, thus giving a greater place to the relation of education. Presentation was also varied, being in the form of a report on the subjects dealt with, instead of a record of the discussions among participants.

R121.0120 Miller, H.P. *Income of the American People.* N.Y., Wiley & Sons, 1955, p. 45-46, 65-68.

Brings out the findings of the 1950 census relating income to education, age, and race without any formal attempt to measure the returns to education.

R121.0140 Page, David A., "Retraining Under the Manpower Development Act: A Cost/Benefit Analysis," *Public Policy, Yearbook of the Graduate School of Public Administration,* ed. C.J. Friedrich, Vol. 13. Cambridge, Massachusetts, Harvard University Press, 1964, pp. 257-267. Also Brookings Institution Reprint No. 98, Washington, D.C.

R121.0160 Safeer, H.B., Bernstein, G., and Wax, S.R. *A Computer Model for Projecting Civilian and Military Manpower.* RAC-P-13. Research Analysis Corporation, McLean, Va., November 1965.

This paper consists of a description of a manpower computer model. The model was designed to overcome limitations to manual calculations which were that only a very limited number of alternative policies could be assessed, and that the interface between civilian and military policies could not be fully appreciated. The computerized model projects the impact of alternative military and civilian manpower management policies. Considered in the alternatives are military draft policies, active duty requirements, military compensation and similar manpower considerations. The principal outputs of the model are (1) flows of manpower between civilian and military pools, (2) projections of manpower characteristics, (3) changes in military strength, and (4) manpower costs.

R121.0180 Strauss, George., "Apprenticeship: An Evaluation of the Need." *Employment Policy and the Labor Market,* ed. by Arthur M. Ross. Berkeley, University of California Press, 1965, p. 299-332.

The occupations in which apprenticeship is most common-construction, printing, machinists, auto mechanics, and barbering–are largely associated with strong union, distinct crafts, small firms, high turnover of employees among firms, and, consequently, attachment of the workers to the labor market as a whole rather than to a particular firm. Individual employers are often too small to provide adequate training programs by themselves, and they have

relatively little incentive to undergo the expense of providing such training, since there is little point in training men who may soon have to work for another employer. Further, gains from such training are much higher from the point of view of the industry as a whole than from that of the individual firm. Thus, the industry-wide apprenticeship program represents an attempt to do collectively what the individual firms are unwilling or unable to do alone. My own opinion is a pessimistic one: though socially desirable, any substantial expansion of apprenticeship is not realistically likely. (Author)

R121.0200 Stromsdorfer, E.W. "Labor Force Adjustment to Structural Displacement in a Local Labor Market," *Industry and Labor Relations Review,* (January 1965), 151-165. Reprinted as Social Systems Research Institute Report No. 90. Madison, Wisconsin, The University of Wisconsin, 1965.

A theoretical analysis forms the human capital viewpoint, together with a case study in the St. Louis metropolitan area. (M. Blaug)

R121.0220 U.S. Congress. Joint Economic Committee. *Federal Programs for the Development of Human Resources.* December 1966. Washington, D.C., Government Printing Office, 1966. Parts I, II, III.

R121.0230 U.S. Congress. House. *Development of Resources and Stabilization of Employment in the United States.* House Document No. 142. 77th Congress, 1st Session, January 1941.

R121.0239 U.S. Department of Labor. *Manpower Report of the President and A Report on Manpower Requirements, Resources, Utilization and Training.* Washington, D.C., Government Printing Office, March 1963.

Employment, population, mobility and productivity trends form the background to comments on manpower prospects in the U.S.A. Means to remove impending difficulties in the manpower situation are discussed, including education, and in the Technical Appendix there is a more detailed examination of the demand for and supply of school teachers.

R121.0240 U.S. Senate. Committee on Labor and Public Welfare. *Selected Readings in Employment and Manpower,* Vol. I: *Exploring the Dimensions of the Manpower Revolution;* Vol. II: *Convertibility of Space and Defense Resources to Civilian Needs: A Search for New Employment Potentials;* Vol. III: *The Role of Apprenticeship in Manpower Development: United States and Western Europe;* Vol. IV; *Lessons from Foreign Labor Market Policies;* Vol. V and VI: *History of Employment and Manpower Policy in the United States.* Compiled for the Subcommittee on Employment and Manpower of the Committee on Labor and Public Welfare United States Senate. Washington, D.C., Government Printing Office, 1964.

From May to December 1963, the Subcommittee on Employment and Manpower conducted extensive hearings on what the Committee called the 'manpower revolution' that was sweeping over American industry. These six volumes reprint materials drawn from learned journals, business weeklies, government documents relating to the changing labor force requirements of the American economy in the fifties, sixties, and seventies; some testimony from the subcommittee's hearing that was considered particularly pertinent has been included. The first volume deals with current and emerging manpower trends (reprinting sections from the President's Manpower Report of 1962) and the much discussed question whether the trend towards automation is creating 'structural unemployment'. The second volume is somewhat less directly related to our central interest, concerned as it is with the impact of the defense programme on the American economy and the problem of adjusting to shifts in defense spending. Volume III on apprenticeship contains information that is generally unavailable elsewhere; it explores the question of the limited role of apprenticeship in the United States in contrast to Western Europe, and includes a survey of apprenticeship practices abroad. Volume IV looks at the unemployment problem in Western Europe, Japan, and the U.S.S.R.; several articles are given over to the 'active labor market policy' of Sweden. The last two volumes are entirely devoted to historical material: Volume V recreates the atmosphere of the thirties by reprinting contemporary discussions of the Great Depression, whereas Volume VI is devoted to the formulation of U.S. employment policies immediately after World War II. (M. Blaug)

R121.0260 U.S. Congress, Senate. Special Subcommittee on the Utilization of Scientific Manpower of the Committee on Labor and Public Welfare. "Scientific Manpower Utilization, 1965-1966". Hearings before the Special Subcommittee on the Utilization of Scientific Manpower. 89th Congress, 1st and 2nd Sessions, November 19, 1965, May 17 and 18, 1966. Washington, D.C., Government Printing Office, 1967, pp. 213.

During the 89th Congress the Subcommittee held two sets of hearings on systems analysis and PPBS in connection with S. 2662, "The Scientific Manpower Utilization Act of 1965." The first set of hearings was held in California, at which time the Subcommittee received testimony on the State's experience with the four systems studies contracted out to local aerospace industries. Representatives of the State, including former Governor Pat Brown, and of the aerospace industry explained the character and scope of the studies on transportation, waste management, crime and information systems.

The second set of hearings focused on the Federal Government and the progress of the extension of PPBS beyond the Department of Defense to the Federal civil agencies. The testifying witnesses were Alain Enthoven, Assistant Secretary of Defense for Systems Analysis; Henry S. Rowen, Assistant Director, Bureau of the Budget; and the agency officials responsible for PPBS in the Department of Health, Education and Welfare (HEW); Department of Housing and Urban Development (HUD); and the Office of Economic Opportunity.

Enthoven outlined the past experience of the Department of Defense with systems analysis. Describing systems analysis as 'quantified common sense,' he gave examples of its use and discussed the organizational arrangements necessary for optimum results. He identified the limitations of systems analysis, but emphasized that they usually were overstated. Enthoven concluded by commenting on the application of systems analysis to problems at the state and local levels.

Rowen, in his testimony, discussed the domestic agencies which, at the time were, in most cases, just beginning to apply systems analysis and program budgeting techniques. PPBS was portrayed as a management system internal to the Executive Branch. Interlacing the system were certain analytical tools, crucial to its success; surrounding it were the problems and opportunities of implementation.

The remainder of the hearings was devoted to the present

and future status of PPBS in HEW, HUD and OEO. Several difficulties in effecting PPBS within each agency were noted. The widely divergent goals of HEW would present a number of obstacles before a department-wide system could function smoothly. The regency of reorganization in the case of HUD would lengthen the changeover time. In a similar way the newness of the poverty program, administered and directed by OEO, in effect has constrained planning due to the limitations and inadequacy of past statistics.

A second document on two subsequent sets of hearings (held in January and March 1967) which also were devoted to the systems approach will be published in the spring of 1967 by the Subcommittee.

Manpower Planning for Canada

R122.0020 Canada. Department of Labour. *Acquisition of Skills.* Research Program on the Training of Skilled Manpower, Report No. 4. Ottawa, Department of Labour, 1960.

A study of the education and training of a sample of 800 qualified tool and die makers, sheet metal workers, floor moulders, draughtsmen, and electronic technicians in 75 firms located in Toronto and Montreal. The central aim of the study was to determine where and how workers acquired their skills; also investigated were the opinions of workers about their training, and the effect of technological changes on training requirements. (M. Blaug)

R122.0040 Canada. Department of Labour, Economics and Research Branch. *Skilled and Professional Manpower in Canada, 1945-1965.* Ottawa, Department of Labour, 1965.

This study contains a discussion of the sources of specialized manpower in Canada, an analysis of shortages in selected occupational groups in 1956, and, lastly, an estimate of prospective requirements for skilled manpower over the decade 1955-1965 in which a forecast of probable net immigration figures heavily. (M. Blaug)

R122.0060 Denton, F.T. *An Analysis of Interregional Differences in Manpower Utilization and Earnings.* Staff Study No. 15. Economic Council of Canada. Ottawa, Canada, Queen's Printer, 1966.

A regression analysis of interregional differences in levels of income in Canada that includes educational densities in each region as one of the determining factors. (M. Blaug)

R122.0070 Johnson, H.G. "The Economics of the 'Brain Drain': The Canadian Case," *Minerva,* (Spring 1965), 299-312.

This article debunks some current shibboleths about the emigration of highly qualified manpower from countries like Canada and the United Kingdom. (M. Blaug)

R122.0080 Meltz, N.M. *Changes in the Occupational Composition of the Canadian Labor Force, 1931-1961.* Economics and Research Branch, Department of Labor, Canada, Occasional Paper No. 2. Ottawa, Canada, Queen's Printer, 1965.

This work is a thorough analysis of the significant changes in occupational composition over the thirty-years period, including an explicit discussion of the implication of the analysis for techniques of forecasting manpower requirements. The author suggests that manpower forecasts of the Parnes-type ought to be supplemented by relative earnings data in a particular way (see pp. 107-109). See also the interesting techniques employed in Ch. 5 (pp. 35-50) for distinguishing between the effects of changes in the supply of a skill and changes in the demand for that skill. (M. Blaug)

R122.0100 Organization for Economic Cooperation and Development. *Manpower Policy and Programmes in Canada.* Reviews of Manpower and Social Policies 4. Paris, OECD, 1966.

Another useful country study, half of which consists of a report by the Canadian authorities and the other half of a report by three outside examiners. A comprehensive bibliography is included. (M. Blaug)

R122.0120 Wilkinson, B.W. "Present Values of Lifetime Earnings for Different Occupations," *Journal of Political Economy,* (December 1966), 556-573.

This important article calculates some net present values of Canadian lifetime earnings in six different occupations and for three levels of education within each occupation from the 1961 Canadian census. It is found that at any one discount rate, there exists a rough similarity of net present values for persons with varying amounts of education. The paper concludes with some comparisons between the findings for 1957 and 1961. (M. Blaug)

Manpower Planning for Europe & Japan

R123.0020 Brown, A., "Output, Manpower and Industrial Skills in the U.K., 1948-1970," *The Residual Factor and Economic Growth,* ed. J. Vaizey. Paris, OECD, 1964.

The 1970 job forecasts of the Cambridge Growth Project of the Department of Applied Economics at Cambridge. (M. Blaug)

R123.0040 Butani, K.N. *Manpower Planning in the U.S.S.R.* New Delhi, Institute of Applied Manpower Research, 1963.

This detailed but uncritical description of methods and techniques of Soviet manpower forecasting is based on the author's participation in a one-month ILO study tour in the USSR in 1963. (M. Blaug)

R123.0060 Great Britain. Committee on Manpower Resources for Science and Technology, U.K. *A Review of the Scope and Problems of Scientific Manpower Policy.* Cmnd. 2800. London, Her Majesty's Stationery Office, 1965.

A summary of the current work of the committee and a useful list of research projects presently under way in Great Britain bearing upon scientific manpower policy. (M. Blaug)

R123.0080 Dewitt, N., "High-Level Manpower in the USSR," *New Directions in the Soviet Economy. Studies Prepared for the Subcommittee on Foreign Economic Policy of the Joint Economic Committee, Congress of the United States. Pt. III: The Human Resources.* Washington, D.C., U.S. Government Printing Office, 1966, p. 789-817.

An up-dated version of the analysis presented in the author's earlier book. (M. Blaug)

R123.0100 Gordon, M.S. *Retraining and Labor Market Adjustment in Western Europe.* Manpower Automation Research Monograph No. 4. Department of Labor, Washington, D.C. Government Printing Office, 1965.

A broad review by an economist of government training programmes in Europe since the war. The closing chapter sums up the lessons of the European experience for the United States. (M. Blaug)

R123.0120 Great Britain. The Office of Health Economics. *Medical Manpower.* London, OHE, 1966.

A pamphlet that reviews the present structure of medical personnel in Great Britain and concludes with some cogent comments on the concept of a shortage of medical manpower. (M. Blaug)

R123.0130 Hollister, R.G. *A Technical Evaluation of the First Stage of the Mediterranean Regional Project.* Paris, OECD, 1966.

This outstanding study analyzes the methods of estimating manpower and educational requirements that were used in the six M.R.P. country-studies. It develops new techniques – such as 'sensitivity analysis', and 'sources-of-change analysis' – for evaluating such estimates: see, particularly, the conclusions of the study, pp. 59-64. An appendix presents comparative statistics for the six M.R.P. countries. (M. Blaug)

R123.0131 Kelley, S.C. "The Role of Incentives in Human Resource Planning," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, p. 27-37.

The article discusses the need for incentives in human resource planning to make it successful in overcoming the inertia of a traditional society.

R123.0140 "Manpower Planning in Eastern Europe," *International Labor Review,* (August 1962), 3-35.

A description of the techniques of manpower planning employed in Communist countries. (M. Blaug)

R123.0160 Kahan, A. "The Economics of Vocational Training in the USSR," *Comparative Education Review,* (October 1960), 75-83.

A review of the history of Soviet efforts to tailor vocational training to the manpower needs of the Soviet economy. (M. Blaug)

R123.0180 Malherbe, E.G. "Manpower Training: Educational Requirements for Economic Expansion," *South African Journal of Economics,* (March 1965), 29-51.

This paper gives a picture of South Africa's present and future manpower requirements, as revealed by a recent sample tabulation of the Population Census of 1960, compared with the present output of her educational institutions at different levels, concluding with some constructive proposals to reform the Republic's educational system. (M. Blaug)

R123.0200 Nicholson, J.S. "The Living Capital of the United Kingdom," *Economic Journal,* (March 1961), 95-107. Reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, J. Vaizey. Paris, UNESCO, 1964.

In this path-breaking article, Nicholson revives Petty's method of valuing human capital, arriving at a figure that is five times the value of physical capital, and concludes with a plea for further study of the implications of this fact. (M. Blaug)

R123.0211 Organizations of American States, Department of Economic Affairs. *Human Resources Assessment and Planning. Procedural and Methodological Considerations.* Washington, D.C., Department of Economic Affairs, General Secretariat, Organization of American States, 1962.

A comparative study of methodology in producing surveys of manpower requirements, an integral part of the process of educational planning.

R123.0220 Roberts, B.C. and Smith, J.H. (eds.). *Manpower Policy and Employment Trends.* London, G. Bell & Sons, 1966.

This series of lectures on British labor markets given at the London School of Economics in 1964 includes a general paper by J.R. Crossley: "Forecasting Manpower Demand and Supply" (pp. 15-25); G.G.C. Routh, "The Changing Pattern of Employment Since 1900" (pp. 35-47), with material drawn from his book; C. Freeman, "Research, Technical Change and Manpower Forecasting" (pp. 47-63); R.R.G. Layard, "Manpower Needs and the Planning of Higher Education" (pp. 63-89), J.H. Smith, "The Analysis of Labour Mobility" (pp. 89-98); N. Sear, "The Future Employment of Women" (pp. 98-111); and D.C. Roberts, J.L. Hirsch, "Factors Influencing Hours of Work" (pp. 111-137). (M. Blaug)

R123.0226 Parnes, H.S. *An Occupational Classification System for the Mediterranean Regional Project.* Paris, Organization for Economic Cooperation and Development, 2 April 1962.

The title explains the subject matter, which is set in the context of manpower and educational planning.

R123.0240 Thomas, B. "From the Other Side: A European View," *Annals of the American Society of Political and Social Science,* (September 1966), 63-72.

A discussion that starts from the United States 1965 Immigration Act and ends up in a full-scale treatment of the current "brain drain" from the developing to the developed world. (M. Blaug)

R123.0333 SVIMEZ. *Criteres et Methodes Pour l'Evaluation de la Structure Professionnelle de l'Emploi en 1951, 1961 et 1975.* Berlin, Deutsche Stiftung fur Entwicklungslander, 1963.

The paper gives a methodological survey of the procedures used in Italy for evaluating the past, present and future occupational structure of employment, work carried out in connection with the OECD Mediterranean Regional Project.

Non-Industrial Countries

R124.0003 Abdel Rahman, I.H., "Manpower Planning in the UAR," *Etude Mensuelle sur l'Economie et les Finances de la Syrie et des Pays Arabes.* Damascus, No. 66, juin 1963, p. 34-47.

The article discusses briefly current activities in manpower planning in the UAR, relating them to educational and occupational factors.

R124.0020 Arles, J.P. "Manpower Mobilization and Economic Growth: An Assessment of Moroccan and Tunisian Experience," *International Labor Review,* (July, 1966) 1-22.

The author assesses the cost-benefit relationship of some North African schemes to utilize unemployed or underemployed manpower in special development projects. (M. Blaug)

R124.0040 Bhalla, A.S. "Manpower and Economic Planning in the Philippines," *International Labor Review,* (December 1966) 550-570.

A survey article of Philippino manpower problems within the framework of over-all economic planning in the Philippines. (M. Blaug)

R124.0060 Blakey, K.A. "The Scope for Manpower Analysis in Planning Production in Certain African Countries," *International Labor Review,* (November 1965), 380-397.

A proposal to introduce manpower-analysis and manpower-costing in every industrial project in Africa, so as to provide a stimulus for the development of specific kinds of technical education and in-training programmes. (M. Blaug)

R124.0066 Charleson, W.R. and Davis, R.G. *Progress Report on Human Resource Development Planning in the Dominican Republic (June-September 1963).* Centre for Studies in Education and Development, Graduate School of Education, Harvard University, 1963.

The paper describes graphically and in detail the work undertaken in initiating human resource planning in the Dominican Republic, highlighting the practical problems which arose.

R124.0070 Crumper, G.E. "Lewis' Two-Sector Model of Development and the Theory of Wages," *Social and Economic Studies,* (March 1963), 37-50.

Discusses some of the difficulties in applying Lewis' model to an economy like the West Indies. Closes with a few remarks pertinent to manpower planning in underdeveloped countries: the necessity to take account of social mobility between different grades of labor. (M. Blaug)

R124.0080 Fogg, C.D., "Manpower Planning," *Managing Economic Development in Africa,* ed. W.A. Hausman. Cambridge, Mass., 1963, p. 51-70.

Describes the technique of ratio analysis in forecasting the manpower requirements of a development plan and reviews the methods used to project the number of additional teachers needed to fulfill 1980 targets for primary and secondary education in Eastern Nigeria. (M. Blaug)

R124.0081 Ducoff, Louis J. *Human Resources of Central America, Panama and Mexico, 1950-1980, in Relation to Some Aspects of Economic Development.* New York, United Nations, 1960.

A study of the relation between demographic factors and economic development which includes reference to the human resource and educational factors involved, and provides much data from which the formulation of regional educational plans could begin.

R124.0092 Erder, Necat, "Forecasting Occupational Structure of the Turkish Labour Force," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, p. 139-46.

An exposition of Turkish experience in forecasting manpower requirements by occupational categories.

R124.0100 Friedlander, S.L. *Labor Migration and Economic Growth: A Case-Study of Puerto Rico.* Cambridge, Mass., Massachusetts Institute of Technology Press, 1965.

This study of the effects of migration on the economy of Puerto Rico includes an interesting attempt to quantify improvements in the quality of the labor force, caused by both emigration of unskilled workers and investment in education, and an attempt to measure the contribution of these improvements to economic growth since 1948. Using a Cobb-Douglas production-function, the author concludes that about 50% of additional output can be attributed to the improved quality of the labor force. (M. Blaug)

R124.0120 Gopalaswami, S.R.A. "The Research Programme of the Institute of Applied Manpower Research," *Manpower Journal,* (April 1965), 17-56.

This report by the director of the Institute of Applied Manpower Research in Delhi gives a good picture of the current research programme of the Institute; a list of published IAMR papers is included. (M. Blaug)

R124.0131 Hamza, M. and Fahmy, M.S. *Techniques of Manpower Planning.* Cairo, Institute of National Planning, 15 June 1963.

This paper is an introduction to the methodology of manpower planning, indicating links with the educational system.

R124.0140 Harbison, F.H., "The Development of Human Resources. An Analytical Outline," *Economic Development in Africa,* (ed.) E.F. Jackson. Oxford, Basil Blackwell, 1965, p. 71-77.

A succinct summary of the author's concept of a 'strategy of human resource development.' (M. Blaug)

R124.0149 Hussein, H. *Manpower Sample Survey in the UAR.* Cairo, Institute of National Planning, 15 May 1963.

A brief critical description of the methodology used in the first manpower sample survey carried out in the UAR is followed by proposals for improving the methodology of subsequent surveys.

R124.0160 Harbison, F.H. "Human Resources, Development Planning in Modernizing Economies," *International Labor Review,* (May 1962), 435-458. Also in *Policy Conference on Economic Growth and Investment in Education, III: The Challenge of Aid to Newly Developing Countries,* Paris, Organization for Economic Cooperation and Development, 1962. Reprinted in *Readings on Education and Economic Development,* eds. M.J. Bowman, V.E. Komarov, M. Debeauvais, and J. Vaizey. Paris, UNESCO, 1964.

Makes a strong case for manpower planning in underdeveloped countries and develops some central considerations of manpower planning strategy. Concludes with a plea for the training of 'strategists in human resource development'. (M. Blaug)

R124.0180 Harbison, F.H. and Ibrahim, I.A. *Human Resources for Egyptian Enterprises.* New York, McGraw-Hill, 1958.

An attempt to outline the labor problems of industrialization in Egypt. Ch. 5 contains a useful sketch of the Egyptian educational system. Ch. 6 appraises Egypt's manpower situation. (M. Blaug)

R124.0200 Institute of Applied Manpower Research. *Demand and Supply of Engineering Manpower (1961-1975).* Second Report on Engineering Manpower Survey. New Delhi, IAMR, 1965.

A long term forecast of the demand for engineers in India against the likely supply of engineering graduates over the next 15 years. The various assumptions on which the forecast is based are discussed and upper and lower limits of the forecast are presented. (M. Blaug)

R124.0220 Organization for Economic Cooperation and Development. *Adaptation of Rural and Foreign Workers to Industry.* International Joint Seminar, Wiesbaden, 10-13 December 1963, Final Report. Paris, OECD, March 1965.

R124.0234 Lederman, Esteban. *Analisis Metodologico de la Planificacion de los Recursos Humanos.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R124.0235 Lederman, Esteban. *Algunos Aspectos Conceptuales en la Planificacion de Recursos Humanos.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R124.0236 Lederman, Esteban. *La Formacion de Recursos Humanos en el Desarrollo Economico y Social de la America Latina.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R124.0237 Lederman, Esteban. Planificacion del Desarrollo Economico y di los Recursos Humanos. *Un Analisis Introductorio.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R124.0238 Lederman, Esteban. *Una Hipotesis Metodologica Sobre la Planificacion de los Recursos Humanos en America Latina.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R124.0240 Paul-Pont, Ika, "Le Developpement Economique et la Formation du Capital Humain en Inde," *Cooperation Technique,* No. 23-24 (juillet-octobre 1961) 11-18.

A brief review in French of some human resource programmes in India and the background against which they are taking place.

R124.0260 Samame, B. "Manpower Problems and Policies in Peru," *International Labor Review,* (February 1966), 127-143.

A review of current manpower problems in Peru and the work being done by the Employment and Human Resources Service of the Peruvian Ministry of Labor. (M. Blaug)

R124.0280 Schultz, T.W., "Investment in Human Capital in Poor Countries," *Foreign Trade and Human Capital,* ed. P.D. Zook. Dallas, Southern Methodist University Press, 1962, p. 3-15.

Argues that the importance of accumulating human capital explains many of the puzzles and paradoxes of the economies of underdeveloped countries. (M. Blaug)

R124.0300 Zolotas, X. *International Labor Migration and Economic Development.* Bank of Greece Papers No. 21. Athens, Bank of Greece, 1966.

The first part of this pamphlet looks at the problems of measuring the economic effects of migration; the author criticizes Grubel and Scott for their 'cavalier' treatment of the losses from the 'brain drain.' Part II gives an analysis of post-war emigration from Greece and discusses ways of limiting emigration, including increased investment in Greek technical education. (M. Blaug)

R124.0301 Shearer, J. and Glazer, M. *Calculo de los Recursos Humanos de alto Nivel que la America Latina Necesitara en 1970.* Washington, D.C., Union Panamericana, *1963.*

The authors qualify the value of their study by emphasizing the insufficiency of the relevant data on which it has been based, and conclude by indicating the omissions to be rectified.

R124.0302 Shearer, John C. *Formacion y Utilizacion de Recursos Humanos en el Empleo.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

Forecasting

R130.0020 Bombach, G., "Long-Term Requirements for Qualified Manpower in Relation to Economic Growth," *Economic Aspects of Higher Education,* ed. S.E. Harris. Paris, Organization for Economic Cooperation and Development, 1964, p. 201-221.

A brilliant discussion of the methodology of manpower forecasting in developed countries, showing how it has been done and suggesting how it might be done better. It is a summary of a longer study which the author prepared for O.E.C.D. (M. Blaug)

R130.0030 Brand, W. *Requirements and Resources of Scientific and Technical Personnel in Ten Asian Countries.* UNESCO Statistical Reports and Studies. Paris, UNESCO, 1960.

After reviewing the methodology of manpower forecasting utilized in India, Burma, the Philippines, Thailand, China, Korea, Japan, Ceylon, Turkey and Viet-Nam, and concludes with recommendations for future research. (M. Blaug)

R130.0040 Klein, V. "The Demand for Professional Womanpower," *British Journal of Educational Studies,* (June 1966), 183-197.

An attempt to forecast the demand for highly trained women in Great Britain, based on a questionnaire sent to 70 professional organizations, with a detailed breakdown of the existing structure of female professional participation. Argues that the reserve of professional womanpower is limited, since already the proportion of married women working is considerable higher in the professions than in unskilled occupations. (M. Blaug)

R130.0047 Novacco, Nino. "Forecasting Employment by Industrial Sectors," *Planning Education for Economic and Social Development.* Paris, Organization for Economic Cooperation and Development, 1963, p. 113-22.

A discussion of employment forecasting, via the intermediary of the productivity associated with future output, particularly in the light of Italian experience.

R130.0060 Organization for Economic Cooperation and Development. *Employment Forecasting.* International Seminar on Forecasting Techniques, Brussels, June 4-7, 1962. Final Report. Paris, OECD, 1963.

This volume contains an expose of the various methods of manpower forecasting and planning by J. Tinbergen (pp. 9-21), an excellent paper reviewing Swedish experience with long-term manpower forecasting by S.O. Doos (pp. 24-58), a review of French manpower forecasts by J. Fourastie (pp. 59-78), and a review of Dutch techniques of forecasting by P. de Wolff (pp. 79-103). (M. Blaug)

R130.0080 Organization of European Economic Cooperation, Office for Scientific and Technical Personnel. *Forecasting Manpower Needs for the Age of Science.* Paris, OEEC, 1960.

Account of a Conference on Forecasting Techniques that met in The Hague in 1959, consisting of three general papers by E.I. Schmidt, P.H. Coombs, and H. Goldstein, 3 technical papers by S. Moberg, M. Bermot-Gauchy and P. de Wolff, brief reports on forecasting experiences in the U.K., Yugoslavia, Italy, India, Japan and Holland, a statement of future work in forecasting by OEEC, a list of institutions concerned with forecasting in the member countries, and a bibliographical check list. (M. Blaug)

R130.0100 Srivastava, R.K. *Projecting Manpower Demand. A Review of Methodology.* Delhi, Directorate of Manpower, 1964.

A useful non-technical presentation of different methods of forecasting manpower demands and a brief review of forecasting experience around the world. The volume includes a lengthy bibliography. (M. Blaug)

RECREATION

R200.0020 Baltimore. Department of Recreation and Parks. *Long Range Recreational Plan.* Baltimore, Maryland, Baltimore Department of Recreation and Parks, 1943.

The City of Baltimore is seriously lacking in both large and small neighborhood recreation areas and facilities. The principal recommendation of this report is that the city undertake a long range plan for the systematic acquisition and development of property to meet this task. (Author)

R200.0040 Baltimore. Council of Social Agencies, Division of Recreational and Educational Agencies. *Recreational Facilities and Programs for New Public Housing Areas.* Report of the Fremont Area Subcommittee of the Advisory Committee to Housing Authority of Baltimore City. May 1954.

Explores the needs, existing programs, and a comparison of existing programs with needed programs for the Fremont area of Baltimore.

R200.0060 Clawson, Marion. *Methods of Measuring the Demand for and Value of Outdoor Recreation.* Washington, D.C., Resources for the Future. Reprint No. 10, 1959.

R200.0080 Clawson, Marion and Knetsch, Jack L. *Outdoor Recreation Research: Some Concepts and Suggested Areas of Study.* Washington, D.C., Resources for the Future, Inc. Reprint No. 43, November 1963.

This article presents several aspects of outdoor recreation in which research might be undertaken, and also suggests that the scientific method in general is applicable to research on outdoor recreation. Classification schemes for the numerous kinds of outdoor recreation areas and activities are presented. While not dealing with water per se, the methodology is applicable to water-based recreation.

R200.0100 Daiute, Robert J. "Methods for Determination of Demand for Outdoor Recreation," *Land Economics,* Vol. 42 (August 1966), 327-338.

Reports the results of a survey of methods for determining demand in order to show the relevance of previously-designed methods both as individual techniques and as parts of a battery of instruments for ascertaining demand for outdoor recreation.

R200.0114 Hawaii. Department of Land and Natural Resources, Division of State Parks. *Report to the First Legislature--A Comprehensive Plan for Hawaii State Parks.* February 1962.

R200.0116 Hulten, John J. and M.A.I. *Report Covering the Proposed Park Development of Kahana Valley.* Department of Land and Natural Resources, Planning Office, March 17, 1965.

R200.0120 Health and Welfare Council of the Baltimore Area. *Recreational Facilities and Programs for the Fremont Area.* Baltimore, Maryland, Health and Welfare Council of the Baltimore Area, 1954.

R200.0140 Health and Welfare Council of the Baltimore Area. *Recreational Facilities and Programs for New Public Housing Areas.* Baltimore, Maryland, Health and Welfare Council of the Baltimore Area, 1952.

R200.0160 Knetsch, Jack L. "Land Values and Parks in Urban Fringe Areas," *Journal of Farm Economics,* Vol. 44 (December 1962), 1718-1729.

Discusses the need to consider the social value of land used for community purposes and means of arriving at measures which will provide the basis for optimal allocation of land.

R200.0180 Knetsch, Jack L. "Outdoor Recreation Demands and Benefits," *Land Economics,* Vol. 39 (November 1963), 387-396.

Examines various promising approaches to the problem of providing information on demand relationships and values, useful for decision purposes.

R200.0200 Mack, Ruth P. and Myers, Sumner, "Outdoor Recreation," *Measuring Benefits of Government Investments,* Dorfman, Robert, ed. Papers presented at a conference of experts, November 7-9, 1963, Washington, Brookings Institution, 1965, p. 71-101.

This paper explores the use of utility functions in cost-benefit analysis, difficulties in estimating benefits are discussed and ways of solving the problem are suggested, along with empirical results from trials of the various methods, e.g., in outdoor recreation at least the panel of experts approach has yielded reproducible data and a figure of $0.30 per hour has emerged as the amount that people are willing to pay on the average for this kind of entertainment. The problems involved in pricing public recreation by reference to private recreation are discussed, and a system of weights is developed that takes into account that some groups derive more benefit than others while using the same facilities.

R200.0217 Nakagawa, Patrick Y. "Mosquitoes and Tourism in Hawaii," *Journal of Environmental Health,* Vol. 26, No. 2 (September-October 1966) 118-119.

R200.0220 Outdoor Recreation Resources Review Commission. *Economic Studies of Outdoor Recreation.* Study Report 24, Washington, D.C., Superintendent of Documents, 1962.

The text of the report is comprised of four papers. In an article entitled "Economic Analysis Bearing on Outdoor Recreation Development," the author applies economic theory and logic to outdoor recreation and deals with concepts of efficiency, investment, timing, and uncertainty. A Commission-prepared paper examines past efforts to measure and evaluate the costs and benefits of outdoor recreation. A third paper analyzes the interrelation of public and private sectors of the outdoor recreation economy. In "Reservoir Recreation and Local Economic Growth," the fourth paper, the effect of outdoor recreation on the economic growth of communities adjacent to large reservoirs is measured.

R200.0222 Planning Council, Greater Baltimore Committee, Inc. *Plan for Conservation and Development of Jones Falls Valley. A Unique Opportunity for the Baltimore Region (A).* Baltimore, Maryland, Planning Council, Greater Baltimore Committee, Inc., 1961.

This brochure presents a case for expenditures for a public park in the Baltimore area. It is lavishly illustrated with maps and pictures, and it was obviously meant for public relations rather than scientific analysis.

R200.0240 Trice, Andrew H. and Wood, Samuel E. "Measurement of Recreation Benefits," *Land Economics,* Vol. 34 (August 1958), 195-207.

See also discussion in *Land Economics,* November 1958, Vol. 34, pp. 365-370.

R200.0260 U.S. Department of Agriculture. *The American Outdoors, Management for Beauty and Use.* Washington, D.C., 1965.

R200.0280 U.S. Outdoor Recreation Resources Review Commission. *Economic Studies of Outdoor Recreation.* Reports by Commission staff, Marion Clawson, and others, Washington, D.C., Government Printing Office, 1962.

Economic analysis bearing upon outdoor recreation, by Ivan M. Lee, p. 1-44; Economic evaluation of outdoor recreation benefits, by the Commission staff, p. 45-69.

R200.0300 U.S. Congress, House, Committee on Interior and Insular Affairs. *Recreation Allocation Policy,* Hearings . . . . 88th Congress, 1st Session, on H.R. 9032. Washington, D.C., U.S. Government Printing Office, 1964.

R200.0316 Walters, George S., Landscape Architect, Wolbrink, Donald and Associates, Inc., Planners, Engineers, Architects, Landscape Architects. *The Nuuanu Pali Natural Park and Region.* Department of Land and Natural Resources, Planning Office, Hawaii, April 1965.

R200.0320 Wennergren, E. Boyd. "Valuing Non-Market Priced Recreational Resources," *Land Economics,* Vol. 40, No. 3 (August 1964), 303-314.

Pleasure boating is used as a model to develop the logic and rationale for one approach to the problem of valuing outdoor recreation. The model is based on the basic principles of demand theory and is applicable to other types of outdoor recreation.

AGRICULTURE

R300.0020 Agricultural Policy Institute, North Carolina State University and the Center for Agricultural and Economic Development, Iowa State University. *Conference on Policies Affecting Rural People.* Papers presented at the conference held in Raleigh, N.C., December 2-3, 1965. Raleigh, 1966.

Costs and benefits of past agricultural programs, by J.C. Williamson, p. 29-49; Evaluating the costs and benefits of past farm programs, by Donald C. Horton, p. 51-57.

R300.0040 Agricultural Policy Institute, North Carolina State University, and the Center for Agricultural and Economic Development, Iowa State University. *Rural America Looks to the Future.* Farm Policy Review Conference, Raleigh, 1964.

Projections of farm income and public costs under several farm program alternatives, by Leo. V. Mayer, Earl O. Heady, and Luther G. Tweeten, p. 59-86.

R300.0043 Alcazar, Jorge. *Algunas Sugerencias para Realizar un Inventario y Diagnostico del Sector Agricola que Sirva Como Base para la Programacion.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R300.0053 Bridger y Fuenzalida. *La Preparacion y Seleccion de Proyectos Agropecuarios en Bolivia.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R300.0070 Diehl, William D. "Farm-nonfarm Migration in the Southeast: A Costs-Returns Analysis," *Journal of Farm Economics,* Vol. 48 (February 1966), 1-11.

R300.0077 Figueroa, Manuel. *Los Factores Productivos en la Agricultura Sobre los Estudios de Economia Agricola.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R300.0078 Figueroa, Manuel. *Sobre los Estudios de la Economia Agricola.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

R300.0080 Griliches, Zvi. "Research Costs and Social Returns: Hybrid Corn and Related Innovations," *Journal of Political Economy,* Vol. 56 (October 1958), 419-431.

Estimates the "realized social rate of return" on investments in hybrid corn research.

R300.0091 Hogg, Howard C. *Feasibility of Diversified Crop Production at Hoolehua.* Department of Land and Natural Resources, Planning Office, Hawaii. n.d.

R300.0100 Johnston, Bruce F. and Mellor, John W. "The Role of Agriculture in Economic Development," *American Economic Review,* Vol. LI, No. 4 (September 1961), 556-93.

The article discusses the role of agriculture in economic development, emphasizing the significance of rural education in this relationship.

R300.0120 Organization for Economic Cooperation and Development. *Cooperative Research to Improve Input/Output Data in Cow Milk Production.* Paris, OECD, September 1965.

The results of an OECD Seminar held at Wageningen (Netherlands) in 1964, to study methods for improving input/output coefficients in cow milk production through closer cooperation between agricultural technical experts and agricultural economists. An initial seminar was held in Paris in 1963 on the preparation of input/output coefficients for beef production, poultry production and the use of fertilizer for crops.

R300.0140 Organization for Economic Cooperation and Development. *Cost-Return Relationships in Agriculture.* Paris, OECD, February 1959.

R300.0160 Organization for Economic Cooperation and Development. *Intellectual Investment in Agriculture for Economic and Social Development.* Paris, OECD, May 1963.

R300.0180 Organization for Economic Cooperation and Development. *Programme Planning.* Paris, OECD, February 1962.

A simple method of determining high profit production plans on individual farms.

R300.0200 Richards, Allen B. "Some Economic Considerations of the Multiple Use of Forest Land," *Land Economics,* Vol. 34 (August 1958), 263-268.

R300.0220 Robinson, K.L. "Cost and Effectiveness in Recent Government Land Retirement Programs in the United States," *Journal of Farm Economics,* Vol. 46 (February 1966), 22-30.

Analyzes the success of land retirement programs in reducing grain surpluses and points out alternative courses of action that would achieve the same objective at a lower cost.

R300.0240 Schultz, T.W. *Transforming Traditional Agriculture.* New Haven, Conn., Yale University Press, 1964.

In this book, Schultz argues, among other things, that 'investment in farm people' constitutes a neglected source of growth in low-income countries. See particularly Ch. 12, pp. 175-207, which reproduces material previously published by the author. (M. Blaug)

R300.0260 U.S. Department of Agriculture. *Agricultural Policies of Foreign Government Including Trade Policies Affecting Agriculture.* Washington, D.C., 1964.

R300.0280 U.S. Department of Agriculture. *Approaches to Income Improvement in Agriculture: Experiences of Families Receiving Production Loans Under the Farmers Home Administration.* Washington, D.C., 1959.

R300.0300 U.S. Department of Agriculture. *Comprehensive Agricultural Program for Puerto Rico.* Washington, D.C., 1953.

R300.0320 U.S. Department of Agriculture. *Costs and Returns on Commercial Farms, Long-Term Study, 1930-1957.* Washington, D.C., 1961.

R300.0340 U.S. Department of Agriculture. *Development Program for the National Forests.* Washington, D.C., 1961.

R300.0360 U.S. Department of Agriculture. *Economic Appraisal of the 1961 Feed Grain Program.* Washington, D.C., 1963.

R300.0380 U.S. Department of Agriculture. *Economic Aspects of Pecan Production and Marketing: Arkansas, Florida, Georgia, Mississippi, New Mexico, and South Carolina.* Washington, D.C., 1963.

R300.0420 U.S. Department of Agriculture. *Economic Effects of Federal Regulation of the Minneapolis-St. Paul Fluid Milk Market.* Washington, D.C., 1952.

R300.0440 U.S. Department of Agriculture. *Economic Impact of Federal Crop Insurance in Selected Areas of Virginia and Montana.* Washington, D.C., 1965.

R300.0480 U.S. Department of Agriculture. *Effects of Acreage-Allotment Programs, 1954 and 1955: A Summary Report.* Washington, D.C., 1956.

R300.0500 U.S. Department of Agriculture. *Evaluation of Agricultural Research.* Washington, D.C., 1960.

R300.0520 U.S. Department of Agriculture. *Forest and Range Influences Publications, 1905-1963.* Publication M2403. Forest Service, Washington, D.C., November 1964.

This bibliography on forest and range influences publications authored by members of the Forest Service is arranged alphabetically by authors in ten subject-matter groupings. It contains some references of interest to those studying the socio-economic aspects of water resources.

R300.0540 U.S. Department of Agriculture. *Losses in Agriculture.* Washington, D.C., 1965.

R300.0560 U.S. Department of Agriculture. *Man, Land, and Food--Looking Ahead at World Food Needs.* Washington, D.C., 1963.

R300.0580 U.S. Department of Agriculture. *New Industrial Crops--Some Economic Considerations.* Washington, D.C., 1962.

R300.0600 U.S. Department of Agriculture. *Opportunities for Economic Development in Low-Production Farm Areas: A Study of Incomes, Employment, and Resources.* Washington, D.C., 1960.

R300.0620 U.S. Department of Agriculture. *Potential Effect of Soil Bank and Corn Allotment Programs on Income and Resource Use, Southern Iowa.* Washington, D.C., 1961.

R300.0640 U.S. Department of Agriculture. *Productivity of Resources Used on Commercial Farms.* Washington, D.C., 1955.

R300.0660 U.S. Department of the Interior. *Research Study Concerning Potential Effects of Radiation Processing on Market Supplies and Structures of the Domestic Fishing Industry.* Washington, D.C., 1966.

R300.0680 Wibberley, G.P. *Agriculture and Urban Growth,* London, M. Joseph, 1959.

WATER

R400.0060 Hawaii. Department of Economic Planning and Development, Planning Division. *Hawaii's Shoreline.* March 1965.

Recommendations for land use and developments along the shoreline areas of the state. Examples include zoning for specific uses, financing public improvements, expanding public recreational areas, and identifying resort development potentials.

Policy

R410.0020 Arrow, Kenneth J. "Criteria for Social Investment," *Water Resources Research,* Vol. 1, No. 1 (First Quarter 1965), 1-8.

An elementary exposition of choice criteria for social investment is presented. The two causes--time preference and opportunity costs--for discounting the future benefits are discussed, and the general reasons for special methods of measuirng benefits are brought out. The issues raised in this paper have applicability to the water resources area.

R410.0040 Bain, Joe S. "Criteria for Undertaking Water-Resource Developments," *American Economic Review,* Vol. 50, No. 2 (May 1960), 310-320.

This article discusses criteria for undertaking water resource developments. Four issues are discussed: the general investment criterion, as defined in terms of the relation of benefits to costs and as made specific for assumed constraints on the investing agency's budget; the interest rate to be used in discounting future benefits and costs; the timing of investment and the avoidance of premature investment; and the influence of procedures in benefit calculation on the design of projects, with special reference to the role of intangible benefits.

R410.0060 Barber, C.L. "Water Resource Development," *Canadian Journal of Economics and Political Science,* Vol. 27 (November 1961). 533-540.

R410.0080 Ciriacy-Wantrup, S.V. "Philosophy and Objectives of Watershed Development," *Land Economics,* Vol. 35, No. 3 (August 1963), 211-221.

This paper deals with the concepts and principles underlying the economics of watershed development which need to be considered for decision-making in public policy. The author emphasizes the relation of watershed development to the market economy and the price system.

R410.0100 "Principles of a Sound National Water Policy–A Re-statement," 1957 Report of the Engineers Joint Council Board of Review, *Civil Engineering,* Vol. 27, No. 5 (May 1957), 52-57.

This article is an expression of views of engineers on national water policy. The single fundamental principle of a sound water policy must be that it meets the needs of the American people. Presented is a statement of broad policy concerning the role of the Federal Government, the need for integrity in financial analysis, reimbursement, uniform policies, and impartial review of proposed projects.

R410.0120 Cliff, Edward P. "Water for A Nation's Needs," *Journal of Soil and Water Conservation,* Vol. 18, No. 5 (September-October 1963), 185-189.

The author says that the challenge of meeting growing water needs and changing patterns of use can best be met by conceiving and implementing sound programs of water conservation and development and watershed protection, improvement, and management. However, such programs must be based upon a thorough technical knowledge; they must be timely, they must involve all appropriate levels of government, and they must be firmly supported by informed and concerned citizenry.

R410.0140 "Law and Contemporary Problems." Durham, North Carolina, Duke University, Vol. 22, No. 2, Spring 1957.

The papers presented at a symposium on river basin development are published in this volume under the following titles: 'A Perspective of River Basin Development;' 'Some Engineering Aspects of River Basin Development;' 'The Economic Dynamics of River Basin Development;' 'The Social Consequences of River Basin Development;' 'The Evaluation of River Basin Development;' 'Basic Water Rights Doctrines and Their Implications for River Basin Development;' 'The Politics of River Basin Development;' 'A Model State Water Code for River Basin Development.'

R410.0160 Fisher, Gordon P. "New Look at Resources Policy," *Journal of the American Water Works Association,* Vol. 57, No. 3 (March 1965), 255-261.

The author makes several general observations regarding 'the water problem'; however, in his opinion, the United States is not confronted with a widespread water shortage. His general observations are then examined in more specific terms related to (1) supply and demand, (2) demand and cost, and (3) law and public policy.

R410.0180 Garnsey, Morris E., "Welfare Economics and Resource Development," *Land and Water: Planning for Economic Growth,* 1961 Western Resources Conference. Boulder, Colorado, University of Colorado Press, 1962, p. 191-204.

The author presents a critical analysis of four books: *Water-Resource Development,* Otto Eckstein; *Multiple Purpose River Development,* John Krutilla and Otto Eckstein; *Efficiency in Government Through Systems Analysis, With Particular Reference to Water Resource Development,* Roland McKean; and *Water Supply: Economics, Technology, and Policy,* Jack Hirshleifer, James C. DeHaven, and Jerome W. Milliman.

R410.0200 Gramm, Warren S. "Limitations of the Theory of the Firm for Water Resource Analysis," *Land Economics,* Vol. 34, No. 2 (May 1958), 113-121.

The author feels that part of the problem causing the imperfect state of present water resource evaluation analysis is excessive dependence on existing value theory. The broad socio-economic purposes of water resource development will be served only by making as inclusive as possible the comparison of cost and benefits of such development. Given are a brief survey of the technological and institutional roots of the problem, followed by a detailed critique of present evaluation techniques.

R410.0220 Gramm, Warren S. "Water Resources Analysis: Private Investment Criteria and Social Priorities," *Journal of Farm Economics,* Vol. 45, No. 4 (November 1963), 705-712.

Private investment and efficiency criteria are discussed as being inadequate guides to public investment decisions. The author contends that optimal development of water, or any other major resource, must include direct consideration of competing alternative uses for the inputs it requires.

R410.0240 Hartman, L.M. and Seastone, D.A. "Welfare Goals and Organization of Decision-making for the Allocation of Water Resources," *Land Economics,* Vol. 41 (February 1965), 21-30.

Identifies, describes, and appraises institutional arrangements for transferring water among users in terms of an efficiency model of water use with special reference to external economies.

R410.0260 Hirshleifer, Jack, De Haven, James E. and Milliman, Jerome W. *Water Supply: Economics, Technology, and Policy.* Chicago, University of Chicago Press, 1960.

In this book, the authors offer a critical analysis of the problems facing the nation in connection with water resources. The allocation of our existing supplies is examined to determine if the use of what we now have meets an acceptable standard of efficiency. Alternative lines of developing additional supplies are discussed. The authors develop economic criteria demonstrating the principles upon which they believe the use of existing supplies and the development of future supplies should be based.

R410.0300 Krutilla, John V. "Is Public Intervention in Water Resources Conducive to Economic Efficiency?" *Natural Resources Journal,* Vol. 6 (January 1966), 60-75.

Considers certain problems in cost-benefit techniques as presently applied and certain deficiencies in the institutional mechanism for Federal planning of water resources development.

R410.0320 Margolis, J. "Water Resource Development," *American Economic Review,* March 1959.

R410.0340 McGee, Gale W., "Water Resources Development: Key to Tomorrow," *Water: Measuring and Meeting Future Requirements,* 1960, Western Resources Conference. Boulder, Colorado, University of Colorado Press, 1961, p. 5-12.

This paper deals mainly with the work being done by the Select Committee on National Water Resources of the United States Senate. The author discusses the projected

needs for water and the estimated costs of meeting these needs. Some of the suggested standards for determining whether to undertake a certain water development program are listed.

R410.0360 Moley, Raymond. *What Price Federal Reclamation?* American Enterprise Association, Inc., Washington, D.C., January 1955.

R410.0380 Moreell, Ben. *Our Nation's Water Resources--Policies and Politics.* Chicago, University of Chicago Press, 1956.

This book consists of five lectures. The first, "Federal Water Policies–Past and Present", traces the evolution of Federal policies affecting water resources development. The second, "Federal Organization for Water Resource Development," discusses the many agencies concerned with this problem and the proposals for reorganization of agency responsibilities. The third lecture, "Federal Development in Navigation, Reclamation and Flood Control," discusses the ways in which benefits are computed on many projects, the extent of direct and indirect subsidies, and the lack of uniformity in the assessment of costs. The fourth, "Federal Power Developments," discusses various phases of Federal participation in water resources development and the public power issue. The fifth is entitled "The Hoover Commission Task Force on Water Resources and Power–Findings and Recommendations".

R410.0400 Fifth Annual New Mexico Water Conference. *Watershed Management.* New Mexico State University, University Park, New Mexico, November 1-2, 1960.

The Conference was arranged in sections, (1) Problems of Watershed Management, (2) Research in Watershed Management, and (3) The Public in Watershed Education. The titles of the papers and the authors are as follows: 'Watershed Management Research', George Ellis; 'Watershed Management Begins on the Land', J.L. Merritt; 'The Watershed Management Program of the U.S. Department of Agriculture', Carl B. Brown; 'Seeding of Summer Cumulus Clouds', Dr. A. Richard Kassander; 'Some Research Findings on the Alamogordo Creek Experimental Watershed', Robert V. Keppel; 'Vegetation Management for Water Yield in the Southwest', H.G. Reynolds; 'Physical and Social Problems in Watershed Management', A.L. McComb; 'Management of Alpine and Subalpine Mountainous Areas for Water Yield', L.D. Love; 'The Rio Puerco – Past, Present, and Future', E.J. Dortignac; 'Research on the Control of Salt Cedar at New Mexico State University', J. Wayne Whitworth; 'Phreatophytes in Region 5', Orlan J. Lowry; 'Salt Cedar Control with Chemicals', Fred Arle; 'The Arizona Watershed Program', Joseph F. Arnold; 'Watershed Management to Increase Water Yield', C.L. Forsling; 'Water and People in New Mexico', Dr. H.R. Stucky; 'Water Needs of Tomorrow', Dr. A.L. Miller; 'State Water Program', Steve Reynolds; 'Report on Governor's Water Resources Committee', Jack Campbell; 'Saline Water Project Roswell – Development', Roger Aston; 'What the Saline Water Conversion Plant Means to the City of Roswell, New Mexico', General C.M. Woodbury; and 'Rio De Penasco Watershed Project', David J. Jones.

R410.0420 Smith, Stephen C. and Castle, Emery N. (eds.). *Economics and Public Policy in Water Resource Development.* Ames, Iowa, Iowa State University Press, 1964.

This book is a composite of various papers centrally concerned with water policy. It is organized into three basic categories of policy: (1) economic evaluation, (2) financing, and (3) law and organization. The analyses and discussion emphasize problems of institutional arrangements.

R410.0440 Steele, Harry A. and Regan, Mark M. "Organization and Administrative Arrangements for an Effective Water Policy," *Journal of Farm Economics,* Vol. 37, No. 5 (December 1955), 886-896. Discussion, Wilfred H. Pine, *Ibid,* 901-903.

In discussing what they feel is an effective water policy, the authors list some guiding principles for establishing a policy, describe the functions needed to achieve policy goals, and show how these functions may be distributed among various levels of government. Wilfred H. Pine comments on and expands some of the views presented by the authors.

R410.0460 Steiner, Peter O. "Choosing Among Alternative Public Investments in the Water Resources Field," *American Economic Review,* Vol. 49, No. 5 (December 1959), 893-916.

The author says that questions involving the amount and form of public investments require criteria for evaluating the investments and operational guides for applying the criteria. In this paper, the author focuses attention on the problem of choosing among alternative public expenditures with particular reference to water resource development.

R410.0480 Timmons, John F. "Economic Framework for Watershed Development," *Journal of Farm Economics,* Vol. 34 (December 1954), 1170-1183.

R410.0500 Timmons, John F. "Theoretical Considerations of Water Allocation Among Competing Uses and Users," *Journal of Farm Economics,* Vol. 38, No. 5 (December 1956), 1244-1258.

The purpose of this paper is to explore the relevant economic considerations in allocating water among uses and users, and thereby to lessen the conflicts, uncertainties, and confusions of water use through the application of economic principles. Examples of programs and policies are used for purposes of illustrating and communicating economic ideas.

R410.0520 The President's Water Resources Policy Commission. *A Water Policy for the American People.* Vol. 1–General Report. Washington, D.C., U.S. Government Printing Office, December 1950.

This report along with volumes 2 and 3 entitled "Ten Rivers in America's Future" and "Water Resources Law", respectively, presents the results of a study made by the temporary seven-member Water Resources Policy Commission. The purpose of the Commission's study was to consider, (a) the extent and character of Federal Government participation in water resource programs, (b) an appraisal of the priority of water resources programs from the standpoint of economic and social need, and (c) desirable legislation or changes in existing legislation relating to the development, utilization, and conservation of water resources. This volume is organized into nineteen chapters and five appendices, and contains numerous tables and figures.

R410.0540 Committee on the Economics of Water Resources Development and Committee on the Economics of Range Use and Development of the Western Agricultural Economics Research Council. *Water and Range Resources and Economic Development of the West--Economic Analysis of Multiple Use, The Arizona Watershed Program–A Case Study*

of Multiple Use. Conference Proceedings. Held at Tucson, Arizona, January 23-24, 1961, Report No. 9, Western Agricultural Economics Research Council, Berkeley, California, 1961.

This series of thirteen papers concerns the policies and problems associated with economic development of water and range resources. Titles and authors of these papers are as follows: 'Multiple Use as a Concept for Water and Range Policy', S.V. Ciriacy-Wantrup; 'Measurement of Problems Relevant to the Irrigation Phase of Watershed Development', A.R. Blanch; 'Some Aspects of Land Ownership and Efficiency of Resource Use from the Public Viewpoint', Walter E. Chryst; 'Diseconomies Inherent in Western Water Laws: A California Case Study', Mason Goffney; 'Pricing Publicly Owned Range and Water Resources', M.F. Brewer; 'Measuring Range Production', H.G. Reynolds; 'Timber Products', Philip N. Knoss; 'Identifying and Measuring the Inputs and Outputs of Watershed Treatment as Related to Wildlife and Recreation', Clay Y. McCulloch; 'Watershed Management Hydrology', P.B. Rowe; 'Multiple Use-Interactions and Problems of Measurement', A.L. McComb; 'Objectives and Methods of Economic Evaluation on the Beaver Creek Watershed Project', David P. Worley; 'The Need for Water in Central Arizona', W.S. Gookin; and 'The Economic Measurement of Watershed Treatments in the Face of Inadequate Technical Data', M.L. Upchurch.

R410.0560 Williams, Ned. L. "Economic Framework and Associated Basic Studies," *Organization and Methodology for River Basin Planning.* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 157-185.

By focusing upon the Tennessee and Missouri River Valley situations, the author proposes to show that the nature and magnitude of the social consequences of river basin development necessarily depend on the peculiar context in which the development transpires. The author concludes that where river basins have no metropolitan centers within or close to their confines, their development will not necessarily result in increased social justice and democratic participation unless accompanied by true regionalism.

R420.0080 Marts, Marion E. *An Experiment in the Measurement of the Indirect Benefits of Irrigation--Payette, Idaho.* Boise, Idaho, Bureau of Reclamation, Region 1, U.S. Department of the Interior, June 1950.

This report shows the relationship between land reclamation and economic development, including the creation of new businesses, new jobs, and new homes. The author attempts to measure indirect benefits stemming from irrigation occurring within a local area. It is concluded that irrigation projects generate income in addition to the total benefits seen by the farmers themselves.

R420.0100 Menz, John A. "The Economic Evaluation of a Drainage Project," *Journal of Soil and Water Conservation,* Vol. 19, No. 1 (January-February 1964), 12-14.

This article is concerned with the determination of incremental benefits resulting from varying scales of project development in a specific subsurface drainage problem area in California. The evaluation procedure outline is well suited for application under the Watershed Protection and Flood Prevention Act, and could be particularly valuable in the formulation of drainage projects in irrigated areas, the author says.

Benefits from Water

R420.0020 Fogarty, Earl R. "Benefits of Water Development Projects," *Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers,* Vol. 82, No. IR2 (May 1956), 981-1-981-8.

This article discusses economic evaluations which must be made on Federal water development projects before authorization and construction. The standards and procedures for these evaluations are left up to the several Federal agencies involved. The author describes some of the methods used to determine benefits and costs of these projects.

R420.0040 Fox, Irving K. and Caulfield, Henry P., Jr. *Getting the Most Out of Water Resources.* Resources for the Future Reprint No. 28. Resources for the Future, Inc., Washington, D.C., May 1961.

The problem of obtaining optimum benefits in water management under present and prospective conditions in the United States is analyzed. Some of the overall objectives of past water development and management programs are examined in the light of conditions confronting the nation now and in the future. Some of the main features of the 'benefit optimization problem' are identified and characterized. The authors also suggest some lines of endeavor and policy changes that may promote optimum benefits in future years.

R420.0060 Kraenzel, Carl F. "The Social Consequences of River Basin Development," *Law and Contemporary Problems,* Vol. 22, No. 2 (Spring 1957), 221-236.

R420.0120 National Research Council, Committee on Oceanography. *Economic Benefits from Oceanographic Research.* Washington, D.C., 1964.

R420.0140 Ogrosky, Harold O. "Effects of Conservation on Water Yield," *Journal of Soil and Water Conservation,* Vol. 18, No. 1 (January-February) 1963, 11-13.

The author says that conservation programs have demonstrated their beneficial effects on the quality and time distribution of water yield. But the effects of such programs on water yields from entire river basins is probably not significant when compared to other changes taking place in major river basins. Conservation measures as applied to major river systems are discussed.

R420.0160 Panel of Consultants on Secondary or Indirect Benefits of Water-Use Projects. *Report of Panel of Consultants on Secondary or Indirect Benefits of Water-Use Projects.* Panel of Consultants: John M. Clark, Eugene L. Grant, and Maurice M. Kelso, Report to Michael W. Straus, Commissioner, Bureau of Reclamation, June 26, 1952, U.S. Department of the Interior, Bureau of Reclamation, Washington, D.C., 1952.

This panel was organized to make an objective appraisal of the disputed procedures for evaluating secondary benefits and costs of Federal water-use projects. This report indicates the panel's views on the adequacy of Bureau of Reclamation procedures for recognizing and evaluating secondary or indirect benefits and costs, and sets forth a recommended basis for the evaluation of secondary or indirect benefits and costs.

R420.0180 Sewell, W.R.D. and M.E. Marts. "The Nez Perce Dam and the Value of a Fishery," *Land Economics,* Vol. 37 (August 1961), 257-260.

R420.0200 Solo, R. "Critical Evaluation of the National Academy of Science's Cost-Benefit Analysis for Oceanographic Research," *Land Economics,* Vol. 42 (November 1966), 527-531.

R420.0220 U.S. Bureau of Reclamation. *Report of Panel of Consultants on Secondary or Indirect Benefits of Water-Use Projects.* Washington, D.C., June 26, 1952.

Panel: John M. Clark, Eugene L. Grant, Maurice M. Kelso.

R420.0240 U.S. Department of Commerce. *Determination of Area Redevelopment Benefits from Water Resource Projects.* Washington, D.C., Area Redevelopment Administration, March 1964.

A basis for quantifying benefits derived from water-resource projects in redevelopment areas is discussed. These benefits may be in addition to the direct project benefits that are normally considered by water resource development agencies.

R420.0260 U.S. Department of the Interior. Office of Water Resources Research. *Bibliography on Socio-Economic Aspects of Water Resources.* Washington, D.C., March 1, 1966.

R420.0280 University of California, Water Resources Center. *Proceedings: Water Resources Economics Conference.* Los Angeles, Calif., September 30-October 2, 1964.

This report discusses recommendations for research and education in the social science aspect of water resources. The recommendations represent the consensus of a group of economists, lawyers, political scientists, and engineers in attendance at the Water Resources Economics Conference at Lake Tahoe, California.

R420.0300 Western Agricultural Economics Research Council. *Water Resources and Economic Development of the West.* Proceedings of the Water Resources Development Committee. . . Reprint No. 0: "Direct and Indirect Benefits," Berkeley, Calif., 1951.

R420.0320 William, Donald A. "Benefits of Small-Watershed Projects to Municipal Water Supplies," *Journal of the American Water Works Association,* Vol. 54, No. 9 (September 1962), 1066-1072.

This article reviews the four major benefits of small-watershed projects to small cities and towns, with emphasis on benefits to municipal water supplies. Benefits in flood protection, recreational opportunities, and stimulation of economic development are discussed.

Pollution Control

R421.0020 Baxter, Samuel S. "Economic Considerations of Water Pollution Control" *Journal of the Water Pollution Control Federation,* Vol. 37, No. 10 (October 1965), 1363-1369.

The economics of the disposal of used water is discussed and the following four questions are considered: (1) what are the purposes and uses expected of receiving streams; (2) what benefits and improvements will occur in the stream if a higher degree of treatment is used; (3) what relation exists between the costs involved in, and the benefits derived from, different degrees of treatment; and (4) what is the relation of these costs and benefits to the costs or benefits of other civic programs.

R421.0040 Beckman, Norman and Dworsky, Leonard, "New Views on Public Responsibility for Resources Development–Jurisdictions, Consequences, and Remedies," *New Horizons for Resources Research: Issues and Methodology,* 1964 Western Resources Conference, Boulder, Colorado, University of Colorado Press, 1965, p. 101-119.

This paper describes how water pollution control has recently been accepted as a public responsibility and how new public policies to manage water quality have been developed. The author considers a number of criteria to evaluate the optimum performance of the water pollution function in urban areas and wider regional settings, identifies and evaluates the range of government machinery being employed in administering the function, and suggests future action with respect to improving the organization, financing, and coordination of urban and regional water pollution control efforts.

R421.0060 Bramhall, David F. and Mills, Edwin S. "Alternative Methods of Improving Stream Quality: An Economic and Policy Analysis," *Water Resources Research,* Vol. 2, (1966), 355-363.

R421.0080 California, State Water Pollution Control Board. *An Investigation of the Efficacy of Submarine Outfall Disposal of Sewage and Sludge.* Pub. No. 14, 1956.

R421.0100 California, State Water Pollution Control Board. *Water Pollution Control Act.* November 1957.

R421.0120 Cleary, Edward J. "Benefit-Cost Considerations in Water Quality Management," *Public Works,* Vol. 94, No. 12 (December 1963), 66, 68, 70.

This article presents the criticisms which were aimed at the analysts of the Corps of Engineers for failing to demonstrate in their proposals for a $500 million program of storage reservoirs in the Potomac River Basin that, (1) the benefits for such a huge expenditure were justifiable, and (2) they had given adequate consideration to alternative ways for dealing with pollution abatement.

R421.0130 Cleary, Edward J. "Economic Implications of Industrial Waste Control," *Public Works,* Vol. 94, No. 2 (February 1963), 64, 66, 68.

The author discusses some of the economic implications of pollution control. An appraisal is made of industry's stake in the conduct of water pollution control. The article examines some information on what industry stands to lose in using degraded water.

R421.0140 Dworsky, Leonard B. *Comprehensive Planning for Water Quality Management-Technical*

Aspects. U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Water Supply and Pollution Control, Washington, D.C. Presented at the 36th Annual Meeting, Water Pollution Control Federation. Seattle, Washington, October 8, 1963.

The author lists and discusses some of the elements that would contribute to forming a comprehensive water quality management plan. Some of the problems of implementing such a plan are described and some alternative courses of action are mentioned.

R421.0160 Hammond, R.J. *Benefit-Cost Analysis and Water Pollution Control.* Miscellaneous Publication No. 13. Stanford, Calif., Food Research Institute, Stanford University, 1959.

This book deals with benefit-cost analysis in general and water pollution problems in particular. This work was under contract to the United States Department of Health, Education, and Welfare. The first part discusses benefit-cost analysis with major attention given to historical development. The last part describes the water pollution problem, evaluates investment in pollution control, and summarizes the study.

R421.0200 Haney, P.D. "Water Pollution Control Policy," *Proceedings of the American Society of Civil Engineers,* Vol. 79, Separate No. 335, November 1953.

R421.0220 Kneese, Allen V. *The Economics of Regional Water Quality Management.* Baltimore, Published for Resources for the Future, The Johns Hopkins Press, 1964.

Discusses the reasons for regulating water pollution, the nature of the problem, methods of treatment and their economic effects, case studies, and details of large-scale treatment programs.

R421.0240 Kneese, Allen V. *Water Pollution: Economic Aspects and Research Needs.* Baltimore, Published for Resources for the Future, The Johns Hopkins Press, 1962.

Evaluation – determination and integration of individual and social values – focus of public policy, p. 29-42; Benefit-cost analysis and the constrained cost minimization framework, p. 42-44.

R421.0280 Renshaw, E.F. "Economics of Pollution Control," *Sewage and Industrial Wastes,* Vol. 30 (May 1958), 680-688.

R421.0300 Stevens, Joe B. "Recreation Benefits from Water Pollution Control," *Water Resources Research,* Vol. 2 (1966), 167-182.

Develops a model of biological and behavioral relationships involved in sports angling as a means of estimating direct recreational benefits from pollution control.

R421.0320 Thomann, Robert V. "Recent Results from a Mathematical Model of Water Pollution Control in the Delaware Estuary," *Water Resources Research,* Vol. 1, No. 3 (Third Quarter 1965), 349-359.

This article discusses the basic concepts of systems analysis and optimum (least-cost) water pollution control. The equations utilized to describe the time and space variability of dissolved oxygen are presented in a systems analysis context, and their usefulness in this form is discussed. The application of the mathematical model to the control of dissolved oxygen in the Delaware Estuary is given. Recent computer solutions are illustrated, and the sensitivity of the least-cost oxygen improvement solutions to the rate of atmospheric reaction is presented.

R421.0340 Thomann, Robert V. and Sobel, Matthew J. "Estuarine Water Quality Management and Forecasting," *Journal of the Sanitary Engineering Division,* Proceedings of the American Society of Civil Engineers, Vol. 90, No. SA5 (October 1964), 9-36.

Techniques are described for the forecasting and optimum management of water quality in the estuarine environment. The understanding of water quality variations can be improved by using a systems analysis approach. The results of the analysis then can be used in programming problems to determine the optimum allocation of funds for several significant water quality control problems. Examples of the nature of estuarine quality changes are presented and the results of a system analysis applied to the Delaware Estuary are given.

R421.0360 U.S. Congress. *Public Law 660. Federal Water Pollution Control Act.* 70 Stat. 498. 84th Congress, Washington, D.C., April 1957.

R421.0380 U.S. Congress. House. *Ohio River Pollution Control.* 3 Vols. House Document No. 266. 78th Congress, 1st Session, Washington, D.C., August 27, 1943.

R421.0400 U.S. Department of Health, Education, and Welfare. *Pollution of Interstate Waters of the Lower Columbia River, Bonneville Dam to Cathlamet.* Washington, D.C., August 1958.

Recreation

R422.0020 Anderson, Jerome F. "Recreation and Fish and Wildlife Studies," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 261-290.

R422.0040 Brewer, M.F., "Incorporating Recreational Values into Benefit-Cost Analysis," *Conference Proceedings of the Western Agricultural Economics Research Council.* August 1962, 22-29. Discussion, L.M. Hartman, 29-31.

This paper discusses the financial issues of benefit-cost analysis and the institutional organization necessary to facilitate repayment of costs and to manage a recreation facility. Certain points concerning the nature of benefits are also mentioned. The discussion is limited to those resources that make possible recreational activities involving bodies of water or water courses. L.M. Hartman offers a few brief comments on various aspects of the issues discussed by Professor Brewer.

R422.0047 Hawaii. Department of Land and Natural Resources, Division of Fish and Game Fisheries

Branch. *Public Fishing Area Development and Operation.* Unpublished, n.d.

R422.0060 Knetsch, Jack L. "Economics of Including Recreation as a Purpose of Water Resources Projects," Resources for the Future, Inc. Reprint No. 50 (January 1965). Reprinted as "Economics of Including Recreation as a Purpose of Eastern Water Projects," *Journal of Farm Economics,* (December 1964), 1148-1157.

The relevant economic measure of recreational benefits is discussed in terms of the willingness to pay on the part of consumers of outdoor recreational services.

R422.0080 Nobe, Kenneth C. "Emerging National Policies Governing Outdoor Recreation in Federal Water Development Projects," *Journal of Soil and Water Conservation,* Vol. 19, No. 2 (March-April 1964), 61-66.

Evolving national recreation policies and their practical implications are discussed. The formerly divergent federal policies affecting outdoor recreation in multipurpose water development projects have yet to be translated into sound procedures for project formulation, the author says.

R422.0100 U.S. Congress. Senate. Committee on Interior and Insular Affairs, *Water Project Recreation Act.* Hearings . . . 89th Congress, 1st session, on S. 1229 . . . Washington, D.C., Government Printing Office, 1965.

R422.0120 U.S. Congress. Senate. Committee on Public Works. *Evaluation of Recreational Benefits from Reservoirs.* Hearings before subcommittee 85th Congress, 1st session, Washington, D.C., March 12-14, 1957.

R422.0140 U.S. Department of the Interior. Bureau of Outdoor Recreation. *Water and Related Land Resources–Planning Manual.* Washington, D.C., June 21, 1965.

This manual provides guidelines for planning and coordinating the outdoor recreation aspects of water and related land resources programs. It established the basis for participation in such programs and sets forth policies and procedures.

R422.0160 Outdoor Recreation Resources Review Commission. *Water for Recreation–Values and Opportunities.* Study Report 10. Washington, D.C., U.S. Government Printing Office, 1962.

The report concerns itself with increased usage of water for recreation, hydrologic aspects in relation to recreational use, limitations on recreational use, qualitative aspects of recreational use, and planning and procedures used by various agencies in the water resources field. It is pointed out that water as a recreational asset is a twofold commodity; there are esthetic as well as economic values. New procedures are needed to evaluate the economic aspects, and esthetic values cannot be measured in economic or monetary terms.

R422.0180 Wennergren, E. Boyd. *Value of Water for Boating Recreation.* Bulletin 453. Logan, Agricultural Experiment Station, Utah State University, June 1965.

The principal objective of this study was to formulate the logic of a consumer surplus model for use in recreational resource evaluation and to apply it to the evaluation of selected sites in northern Utah. Although the study is of a local nature, the methodology involved here has wider applications.

R422.0200 Western Agricultural Economics Research Council, "Water Resources and Economic Development of the West," Proceedings of the Water Resources Development Committee . . . Report No. 13: *Economics in the Decision-Making Process: Economics of Water Based Outdoor Recreation.* Berkeley, California, 1964.

R422.0220 White, William M. "Evaluation of Recreation in Water Developments," *Journal of the Power Division,* Vol. 91, No. P01, Proc. Paper 4306, (May 1965), 1-9.

Enhancement of fish and wildlife and outdoor recreation opportunities is now recognized as a valid and vital purpose of developing the nation's water resources. The challenge before the planner is to reflect these purposes both in project design and economics. Recognition of their benefits to society has required the development of economic evaluation factors (benefits) comparable to others used in (1) establishing economic feasibility of projects and (2) allocating costs among purposes served. The latter is necessary because costs assigned to some beneficiaries must, by law, be rapid. Evaluations were initially based on recreationists' expenditures but were found incomparable with net benefits assigned to other project purposes. Daily unit values applicable to expected human use were developed administratively using limited data and expert judgment and have been used satisfactorily since 1961. Benefits not adequately reflected by on-site recreational use, such as waterfowl conservation refuges, are evaluated by reference to alternate costs. Futher experience with fee recreation will permit the collection of data to reassess the schedule of daily values.

R422.0420 Young, Lewis A., "Water Supplies, Pollution Abatement, Public Health and Low-Flow Augmentation Studies," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 335-357.

Floods

R423.0017 Hawaii. Department of Land and Natural Resources, Division of Water and Land Development. *Flood Control and Flood Water Conservation in Hawaii–Volume I: Floods and Flood Control.* Hawaii, January 1963.

R423.0018 Hawaii. Department of Land and Natural Resources, Division of Water and Land Development. *Flood Control and Flood Water Conservation in Hawaii–Volume II: General Flood Control Plan for Hawaii.* Hawaii, January 1963.

R423.0020 Hibdon, James E. "Flood Control Benefits and the Tennessee Valley Authority,"

The Southern Economic Journal, Vol. 25, No. 1 (July 1965), 48-63.

An estimate of the benefits of the TVA's flood control program is made. Claims regarding the magnitude of these benefits are studied in order to determine their worth as guides to socio-economic endeavor.

R423.0040 Krutilla, John V. "An Economic Approach to Coping with Flood Damage," *Water Resources Research,* Vol. 2 (Second Quarter, 1966), 183-190.

Demonstrates that a compulsory flood use insurance scheme is one means of achieving efficient use of flood plain lands.

R423.0060 Laton, Burle C., "Flood Control, Navigation, Hydroelectric Power and Industrial Development Studies," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 301-327.

R423.0080 Leopold, Luna B. and Maddock, Thomas, Jr. *The Flood Control Controversy, Big Dams, Little Dams, and Land Management.* N.Y., The Ronald Press Co., 1954.

This book investigates a number of the factors regarding flood control. Much of the material was gathered from unpublished government agency reports and from discussions with technicians. The authors discuss some recurring questions: the definition of the public interest; the allocation of the costs and benefits of resources development; and the economic and political means for carrying this development forward. The flood control controversy is pictured as illustrating the conflicts of interest and opinion that arise over matters of resource development and use.

R423.0100 Resources for the Future, Inc., "Neglected Alternatives to Flood Protection," *Annual Report for 1964,* Washington, D.C., December 1964, p. 15-24.

This report discusses some of the problems of flood plain occupance. It is suggested that flood control programs may have encouraged more people than would have otherwise done so to build on flood plains in the belief that the hazard of flood damages had been entirely removed. Surveys have shown that in recent years there has been an increase in flood damage and suggestions are made, such as zoning, for reducing the hazard of flood damage.

R423.0120 U.S. Department of Agriculture. Soil Conservation Service. *Interim Economics Guide for Watershed Protection and Flood Prevention.* Washington, D.C. May 14, 1956.

R423.0140 White, Gilbert F. *Choice of Adjustments of Floods.* Research Paper No. 90. Chicago, Chicago University, Department of Geography, 1964.

Problems of comparing adjustments, p. 83-92; Judging alternative investments, p. 93-105; Economic effect of local flood protection measures, p. 127-149.

Irrigation

R424.0020 Anderson, Raymond L. *Irrigation Enterprises in Northeastern Colorado–Organization, Water Supply, Costs.* Washington, D.C., United States Department of Agriculture, Economic Research Service, Resource Development Economics Division, ERS-117. June 1963.

This report describes the variation in size of operation, costs of water delivery, and market value of water among 106 irrigation enterprises, generally private, in the South Platte Basin of Colorado. The information reported is useful in studying the value of irrigation water as estimated from farm sale values and in analysis of the water rental market.

R424.0040 Anderson, Raymond L. and Hartman, L.M. *Introduction of Supplemental Irrigation Water.* Fort Collins, Colorado, Colorado State University Agricultural Experiment Station, Technical Bulletin 76, June 1965.

This bulletin reports farm changes made by farmers in the South Platte Basin of Colorado in response to supplemental irrigation water supplies, changes in land use, crops, crop yields, water application, fertilizer use, and capital improvements are summarized.

R424.0060 Castle, Emery N. "Evaluating Investment in Supplemental Irrigation," *Journal of Soil and Water Conservation,* Vol. 17, No. 3 (May-June 1962), 120-122.

Linear programming, the author says, has been suggested an excellent tool for planning watershed development programs; however, its use may lead to substantial overinvestment in some conservation practices. The purposes of this article are to illustrate a possible application of linear programming; underline the importance of knowing more about physical production functions for water; and indicate that even if all of the physical relationships involved were known, it would still be difficult to aggregate the information in a meaningful manner.

R424.0080 Hartman, L.M. and Anderson, R.L. "Estimating the Value of Irrigation Water from Farm Sales Data in Northeastern Colorado," *Journal of Farm Economics,* Vol. 44, No. 1 (February 1962), 207-213.

This article discusses the value of irrigation to farms. Data on northeastern Colorado farm sales over a six year period are used as a basis for determining the value of irrigation. The equations used in this study are generally applicable.

R424.0100 Hartman, L.M. and Wittelsey, N. *Marginal Values of Irrigation Water.* Technical Bulletin 70. Fort Collins, Colorado, Agricultural Experiment Station, Colorado State University, 1961.

This study consists of a linear programming analysis of farm adjustments to changes in water supply. Three farm models having different enterprise alternatives were used in the analysis. Fixed resources or limitations in the models consisted of land, monthly water supplies. Solutions were programmed for three monthly water supply situations.

R424.0120 Haver, C.B. and Renshaw, E.F. *The Impact of Federal Investments in Irrigation and Reclamation of Inter-Regional Competition.* N.R. Paper No. 21. Chicago, Ill., University of Chicago, December 17, 1957.

R424.0140 Kimball, Norman D. and Castle, Emery N. *Secondary Benefits and Irrigation Project Planning.* Technical Bulletin 69. Corvallis, Agricultural Experiment Station, Oregon State University in cooperation with the U.S. Department of Agriculture, May 1963.

This report states the principle theoretical issues associated with indirect benefits, and presents some indicators of secondary benefits for the North Unit Project in Jefferson County, Oregon. The extent of this economic activity is of interest to local citizens and to state planners as well as to those who are concerned about water resource development on a national scale. Project planning is also discussed.

R424.0160 Margolis, Julius. *The Discount Rate and the Benefits-Costs Justification of Federal Irrigation Investment.* Tech. Rept. No. 23. Stanford, Calif., Department of Economics, Stanford University, 1955.

R424.0180 Moore, Charles V. "Economics of Water Demand in Commercialized Agriculture," *Journal of the American Water Works Association,* Vol. 54, No. 8 (August 1962), 913-920.

A demand schedule is estimated for irrigation water in a farm area of the San Joaquin Valley of Southern California. The value of temporal redistribution of a limited supply of water by use of storage is estimated.

R424.0200 Pavelis, George A. "Irrigation Policy and Long-Term Growth Functions," *Agricultural Economics Research,* Vol. 17, No. 2 (April 1965), 50-60.

A method for projecting the acreage of farmland irrigated in the 22 major water resource regions of the United States is described. The method incorporates: (1) a statistical analysis of irrigation development observed between 1939 and 1959, (2) economic limits on irrigation that recognize variations in soils and water supplies, and (3) estimates of the absolute and relative importance of Federal and non-Federal irrigation development. The method is used to quantify regional variations in the sensitivity of irrigation policies ranging from one involving minimal Federal and modest non-Federal development to one postulating no policy constraints on development.

R424.0220 Reutlinger, Shlomo and Seagraves, James A. "A Method of Appraising Irrigation Returns," *Journal of Farm Economics,* Vol. 44, No. 3 (August 1962), 837-850.

A method of computing the added crop yield from a series of irrigation experiments is described. The method is explained with the aid of an example in which an expected yield increase and synthetic cost data are used to evaluate the profitability of investing in irrigation systems for tobacco in the Coastal Plain of North Carolina.

R424.0240 Ruttan, Vernon W. *The Economic Demand for Irrigated Acreage: New Methodology and Some Preliminary Projections, 1954-1980.* Resources for the Future, Inc. The Johns Hopkins Press, Baltimore, Md., 1965.

This study presents a method for determining the economic demand for irrigation. It explores whether, and to what extent, irrigated acreage can be expanded within the constraints of economic efficiency to meet the projected demands for agricultural output. This study is a criticism of, and a potential substitution for, the traditional 'projection-of-requirements' method of forming policies and plans for public investment in water resources development.

PLANNING

R430.0020 Ackerman, Edward A. "Questions for Designers of Future Water Policy," *Journal of Farm Economics,* Vol. 38, No. 4 (November 1956), 971-980.

In determining water policy, the author says that consideration must be given to the geographical environment; technology, which shapes the tools used for development and influences the demand for water; location and move ment of population; the public interest; and national defense.

R430.0040 Beattie, Byron, "Multiple Use–Watershed Management Relationships: Concepts and Practices," *Proceedings.* Society of American Foresters, Atlanta, Georgia, 1962, p. 112-114.

This paper defines the multiple-use concept and how it can be applied to management objectives. Watershed management in the multiple-use concept and the National Forest Watershed Program is discussed. It is pointed out that watershed managers must make ever increasingly effective contributions if multiple-use objectives are to be attained.

R430.0060 Bird, Kenneth C., "Coordination of Local, State and Federal Interests," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 413-422.

R430.0080 Brandt, Karl, "Problems in Planning for Future Demand of Water," *Proceedings of a Conference on the Economics of California's Water Development,* Berkeley, University of California, February 1958.

R430.0100 Burt, Oscar R. "Optimal Resource Use Over Time with an Application to Ground Water," *Management Science,* Vol. 11, No. 1 (September 1964), 80-93.

This paper is concerned with optimal allocation over time of a single resource which is either fixed in supply or only partially renewable at a point in time. A functional equation is obtained from a dynamic programming formulation of the problem. This functional equation is used to derive approximate decision rules for resource use as a function of current supply. The results are applied to groundwater storage control and tested empirically by comparison with a decision rule obtained by detailed numerical methods.

R430.0120 Chun, Robert Y.D., Mitchell, Louis R. and Mido, Kiyoshi W. "Ground-Water Management for the Nation's Future–Optimum Conjunctive Operation of Ground-Water Basins," *Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers,* Vol. 90, No. HY 4 (July 1964), 79-95.

A method for determining the most economical plan for conjunctive operation of ground and surface systems has been developed. The concepts and techniques developed as an integral part of this method are described. They include the use of mathematical models in analyzing the hydraulic characteristics and responses of ground-water basins and pipeline networks, the determination of facility and operational costs for various plans of operation, and cost comparisons. To rapidly evaluate the physical and economic effects of the large number of alternatives, electronic computers were used extensively.

R430.0140 Ciriacy-Wantrup, S.V. *Projections of Water Requirements in the Economics of Water Policy.* Berkeley, California, University of California, Giannini Foundation Paper No. 193, September 1960.

The relation between the meaning of water demand in the language of the economist, and the meaning of water requirements as used in the literature on water development, is discussed and clarified. Questions with respect to the logic and relevance of projecting water requirements into the future are raised.

R430.0160 Conway, Clarence M., "A Brief History of the U.S. Study Commission, South East River Basin, and a Summary Description of Its Report," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater, Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 15-38.

R430.0180 Conway, Clarence M., "The Commission's Approach to Plan Formulation," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 409-411.

R430.0200 Conway, Clarence M., "Plan Formation, and Responsibility for Plan Implementation," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 445-474.

R430.0220 Engineers Joint Council. Water Policy Panel. *National Water Policy.* June 1950, 2nd ed., October 1950.

R430.0240 Fox, Irving K., "Review and Interpretation of Experiences in Water Resources Planning," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 61-88.

R430.0260 Green, William A. "Comprehensive River Basin Planning–Economic Considerations," *Journal of Soil and Water Conservation,* Vol. 19, No. 4 (July-August 1964), 143-146.

The author outlines the economic aspects of regional studies, designated "framework investigations," by government agencies, leading to the formulation of river basin plans for the development of water and related land resources. Elements considered in such studies include projections of economic development and demands for water, forecasts of water quality and quantity, land resource availability, and objectives for meeting needs in terms of land and water management. An approach to the agricultural and rural aspects of framework studies is suggested.

R430.0271 Hawaii. Department of Land and Natural Resources, Division of Water and Land Development. *A Domestic Water Plan for Kaunakakai-Pukoo, Molokai.* January 1962.

R430.0280 Hufschmidt, Maynard M. "Field Level Planning of Water Resource Systems," *Water Resources Research,* Vol. 1, No. 2 (Second Quarter 1965), 147-163.

This paper examines the process of comprehensive water resources planning from the point of view of how new knowledge can best be brought to bear on the major planning tasks under way. A general outline of the process of field level planning is presented, and the most significant new techniques are discussed.

R430.0300 Hufschmidt, M.M. "Water Resources System Design," *Water and Sewage Works,* Vol. 110, No. 5 (May 1963), 195-198.

The author discusses techniques for relating economic objectives, engineering analysis, and planning in water-system design. Applying principles and standards of economic analysis in a consistent manner in river system analysis is a desirable practice. The two major techniques discussed for examining complex river-systems are simulation and the mathematical model approach.

R430.0320 Hufschmidt, Maynard M. and Fiering, Myron B. *Simulation Techniques for Design of Water Resource Systems.* Cambridge, Harvard University Press, 1966.

Develops the methodology for constructing decision models, using as an example a simulation program for the Lehigh River Basin.

R430.0340 Johnson, Ralph W. "Some Myths about Water Shortages," *University of Washington Business Review,* (October 1964), 5-10.

The author expresses his own views about long range water planning in the western United States. He states that water, like any other resource, has a cost, and that intelligent evaluation of water shortage and of the need for transfer of water to other areas should begin with benefit-cost analysis.

R430.0360 Kindsvater, Carl E. "An Experiment in River Basin Planning," *Organization and Methodology for River Basin Planning.* Water Resources Center, Georgia Institute of Technology, Atlanta, Georgia, 1964, p. 11-13.

R430.0380 Kindsvater, C.E. (ed.). *Organization and Methodology for River Basin Planning.*

Proceedings of a Seminar Based on The U.S. Study Commission–Southeast River Basins. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964.

Contents: "An Experiment in River Basin Planning" by Carl E. Kindsvater; "A Brief History of the U.S. Study Commission (SERB) and a Summary Description of its Report" by Clarence M. Conway; "Legislative History of Federal River Basin Planning Organizations" by Theodore M. Schad; "Review and Interpretation of Experiences in Water Resources Planning" by Irving K. Fox; "Organization and Management of the U.S. Study Commission, Southeast River Basins" by J.W. Woodruff, Jr.; "Objectives, Concepts, Policies and Guidelines" by George E. Tomlinson; "Economic Framework and Associated Basic Studies" by Ned L. Williams; "Hydrologic and Climatologic Studies" by Walter T. Wilson; "Engineering, Geology and Cost Studies" by Lester W. Angell; "Objectives, Criteria and Methodology" by J.F. Anderson; "Recreation and Fish and Wildlife Studies" by J.F. Anderson; "Flood Control, Navigation, Hydroelectric Power and Industrial Development Studies" by Burle C. Laton; "Water Supplies, Pollution Abatement, Public Health and Low-Flow Augmentation Studies" by L.A. Young; "Reclamation, Irrigation and Drainage, Forest Conservation and Utilization, Soil Conservation and Utilization, Salinity and Sediment Control Studies" by H.P. Morgan; "The Commission's Approach to Plan Formulation" by Clarence M. Conway; "Coordination of Local, State and Federal Interests" by Kenneth C. Bird; "Evaluation of Local Viewpoints and Problems" by Paul H. Shore; "Plan Formulation, and Responsibility for Plan Implementation" by C.M. Conway; and "An Evaluation of the U.S. Study Commission, Southeast River Basins" by Robert H. Pealy.

R430.0400 Krutilla, John V. "Some Recent Developments in River Basin Planning and Evaluation," *Journal of Farm Economics,* Vol. 50 (December 1958), 1674-1687.

Also available as Resources for the Future. Reprint No. 11.

R430.0420 Maass, Arthur, Hufschmidt, Maynard M., Dorfman, Robert, Thomas, Harold A., Jr., Marglin, Stephen A. and Fair, Gordon Maskew. *Design of Water Resource Systems.* Cambridge, Massachusetts, Harvard University Press, 1962.

This book represents a major product of the 5-year Harvard Water Program. It focuses upon the methodology and techniques that are felt to be useful in the design of water-resource systems.

R430.0440 Milliman, J.W. *An Economist Looks at State Water Planning.* Paper presented to the Water and Power Commission, Los Angeles Chamber of Commerce, November 1, 1957.

R430.0460 Morgan, Horace P. "Reclamation, Irrigation and Drainage, Forest Conservation and Utilization, Soil Conservation and Utilization, Salinity and Sediment Control Studies," *Organization and Methodology for River Basin Planning.* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 363-398.

R430.0480 "Symposium: Water Resources Research," *Natural Resources Journal,* Vol. 5 (October 1965) 218-297.

Research on comprehensive planning of water-resource systems, by Maynard M. Hufschmidt; Economic and related problems in contemporary water resources management, by Allen V. Kneese.

R430.0500 Pavelis, George A., Johnson, Howard P., Scrader, William D. and Timmons, John F. *Methodology of Programming Small Watershed Development.* Agricultural and Home Economics Experiment Station, Iowa State University of Science and Technology, Ames, Iowa, Research Bulletin No. 493, April 1961.

This is a study of some physical and economic aspects of planning for the conservation and development of soil and water resources on a small watershed basis. Specific problems covered are: (1) applying multipurpose concepts, (2) reconciling the economic objectives and management plans of farmers who control watershed uplands with the objectives and plans of other private or public economic subunits affected by upland use, and (3) formulating optimal development programs for small watersheds.

R430.0520 Pavelis, George A. and Timmons, John F. "Linear Programming: A New Tool for Watershed Planning," *Journal of Soil and Water Conservation,* Vol. 15, No. 1 (January 1960), 5-10.

This article reviews briefly the treatment of certain planning problems in a research study on the Nepper Watershed in western Iowa. These problems are common to small watershed planning, relating specifically to the agronomic, engineering, and economic phases of such projects. The first is that of applying multipurpose concepts to areas much smaller than those with which they have been previously identified. Second, it is necessary to reconcile the economic objectives of farmers controlling upstream watersheds and public and private interests downstream. Finally, programs must be formulated to accomplish the related economic objectives of maximizing social net returns over time, and equitably allocating costs among the beneficiaries of the project. The application of linear programming to the solution of these problems is described. Results are compared with those of conventional benefit-cost analysis.

R430.0540 Pavelis, George A. and Timmons, John F. "Programming Small Watershed Development," *Journal of Farm Economics,* Vol. 42, No. 2 (May 1960), 225-240.

Two of the objectives for optimal development of watershed programs are: (1) maximizing discounted net returns from watershed resources; and (2) allocating development costs equitably among various private or public participants. The author discusses how these might be achieved within a comprehensive planning framework, combining benefit-cost analysis and linear programming.

R430.0560 Pealy, Robert H. "An Evaluation of the U.S. Study Commission, Southeast River Basins," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 487-521.

R430.0580 Schad, Theodore M., "Legislative History of Federal River Basin Planning Organization," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 41-60.

R430.0600 Shore, Paul H., "Evaluation of Local Viewpoints and Problems," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 427-442.

R430.0620 Steele, Harry A. "Economics of Small Watershed Development," *Agricultural Economics Research,* Vol. 8, No. 1 (January 1956), 17-23.

This article discusses the Watershed Protection and Flood Prevention Act, and the assistance available under this act in the planning and installation of small watershed development measures. The legislative development of the program, its dependence on economical appraisal, and the economic research needed to make it fully effective are considered.

R430.0640 Tolley, G.S. and Riggs, F.E. (eds.). *Economics of Watershed Planning.* Ames, Iowa, Iowa State University Press, 1961.

The chapters of this publication, along with their respective authors, are as follows: "Philosophy and Objectives of Watershed Policy," S.V. Ciriacy-Wantrup; "Where Does Watershed Development Fit Into the Total Picture of Resource Development?", Gladwin E. Young; "The Benefits From Watershed Development," Erwin C. Ford, Elco L. Greenshields, Fletcher E. Riggs, and George S. Tolley; "Potential Investment in Small Watersheds," Morris L. Weinberger; "The Watershed as an Entity for Planning," Fletcher E. Riggs; "Meshing Watershed Development With River Basin Development," Ayers Brinser; "Interdisciplinary Hydrologic, Geologic, and Engineering Data," Ludwig L. Kelly; "The State of the Economic Data," C.V. Lyle; "Does the State of the Data Suggest a Program for Modifying Planning and Evaluation Procedures?", George S. Tolley and Ralph A. Freund, Jr.; "Applying Economic Principles in Watershed Planning," George A. Pavelis; "Programming Structures in Watershed Development," Emery N. Castle; "Estimation of Income and Hydrologic Effects of Alternative Watershed Programs," Arthur J. Coutu; "Mathematical Analysis: Models for Quantitative Application in Watershed Planning," Earl O. Heady; "Mathematical Analysis: Design of the Simple Valley Project," Robert Dorfman; "Economically Desirable Institutional Arrangements and Cost-Sharing Requirements," Mark M. Regan; "Organization for Watershed Planning in the Public Interest," Robert E. Lowry; "Relationships Between Water and Other Property Rights and Small Watershed Development in the Eastern States," Harold H. Ellis; "State District Laws as They Affect Watershed Development," Robert C. Otte; "Model Watershed District Act," Milton S. Heath, Jr; "Suggestions for Fostering Optimum Watershed Development," Harry A. Steele.

R430.0660 Tomlinson, George E. "Land and Water Resources Development Plan," *Journal of Soil and Water Conservation,* Vol. 18, No. 3 (May-June 1963), 109-113.

This article summarizes the important features of a plan for the development of land and water resources in the southeastern United States. The plan was revealed in a proposed report prepared by the United States Study Commission, Southeast River Basins. The report details the Commission's conclusions and recommendations after it took a "40-year look-into-the-future" at an 80,000 square mile area in Alabama, Georgia, Florida, South Carolina, and North Carolina.

R430.0680 Tomlinson, George E., "Objectives, Concepts, Policies and Guidelines," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 105-124.

R430.0700 U.S. Congress. House. Committee on Interior and Insular Affairs. *Lower Colorado River Basin Project.* Hearings before the Subcommittee on Irrigation and Reclamation. 89th Congress, 1st session on H.R. 4671, Washington, D.C., Government Printing Office, 1965, pt. 2, p. 1493-1539.

R430.0720 U.S. Congress. House. Committee on Interior and Insular Affairs, *Water Project Planning Policy.* Hearings before the Subcommittee on Irrigation and Reclamation . . on policies and procedures applicable to the planning of water resource development projects, 88th Congress, 1st session, Washington, D.C., Government Printing Office, 1963.

R430.0740 Weber, Eugene E. "Comprehensive River Planning–Development of a Concept," *Journal of Soil and Water Conservation,* Vol. 19, No. 4 (July-August 1964), 133-137.

The author traces the history of water resource planning in the United States through the development of river basin planning concepts and standards. The standards for river basin planning set forth in Senate Document 97 are discussed, along with related legislation.

R430.0760 Woodruff, J.W., Jr., "Organization and Management of the U.S. Study Commission, Southeast River Basins," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 95-103.

R430.0780 Young, Gladwin E. "Comprehensive River Basin Planning–The Role of Agriculture," *Journal of Soil and Water Conservation,* Vol. 19, No. 4 (July-August 1964), 138-142.

The author states that river basin planning is focused on water management, which is not necessarily an appropriate basis for all other resource or economic development planning. The limitations of river basin planning in achieving national development objectives are pointed out. Yet it is stated that river basin planning can make immeasurable contributions to the solution of problems of water resource use and development. Legislative and administrative obstacles to river basin planning are discussed.

Alternatives

R431.0020 Hall, Warren A. "Aqueduct Capacity Under an Optimum Benefit Policy." Proceedings of the American Society of Civil Engineers. *Journal of the Irrigation and Drainage Division,* Vol. 87, No. IR3, September 1961.

This paper is concerned with the problem of determining the best allocation of water to geographic districts served sequentially by an aqueduct. A method of solving the problem using dynamic programming as an optimization

device is presented. The method is intended for application to water resource development planning rather than to allocation of water from existing aqueducts.

R431.0040 Kneese, Allen V., "Some Economic Effects of Alternative Water Use Patterns In New Mexico," *Water: Measuring and Meeting Future Requirements,* 1960 Western Resources Conference. Boulder, Colorado, University of Colorado Press, 1961, p. 147-156.

The author describes a study undertaken to attempt to define the results of using New Mexico's allotment of water in alternative ways. The results are stated in terms of additions to the gross state product, the level of personal income payments, and the level of employment. The range of gross-product contribution of agriculture, recreation, and industry is given on a per acre-foot of water depleted basis.

R431.0060 Powell, Sheppard T. "Relative Economic Returns from Industrial and Agricultural Water Uses," *Journal of the American Water Works Association,* Vol. 48, No. 8 (August 1956), 991-992.

Certain economic aspects of water use in industry as opposed to its use in agriculture are briefly discussed.

R431.0080 Roberts, N. Keith and Wennergren, E. Boyd. "Economic Evaluation of Stockwater Developments," *Journal of Range Management,* Vol. 18, No. 3 (May 1965), 118-123.

The economic decision of a rancher to engage in stockwater development is studied in terms of returns on investments and in range improvement practices. Careful analysis of proposed development projects can enable the rancher to make sounder economic decisions.

R431.0100 Rose, John L. "Economic Analysis of Projects for Secondary Sources of Water Supply," *Journal of the American Water Works Association,* Vol. 54, No. 11 (November 1962), 1361-1369. Discussion, Jerome B. Wolff, 1369-1370.

Factors bearing on the economic analysis of projects for secondary water supplies and on the methods of analysis are discussed. The three factors identified are: (1) the capacity factor of the proposed project, including the firming effect on the primary water supply; (2) the conjectural nature of the demand projections; and (3) the ability of alternative plans to be completed in stages. In his discussion, Mr. Wolff points out that the techniques described in the article can be used to analyze certain elements of the primary system when future demand variables are considered.

R431.0120 Wollman, Nathaniel, et al. *The Value of Water in Alternative Uses, with Special Application to Water Use in the San Juan and Rio Grande Basins of New Mexico.* Albuquerque, New Mexico, The University of New Mexico Press, 1962.

The study described was undertaken to determine the economic effects of different patterns of water use. The study was divided into three major areas: agriculture, municipal and industrial uses, and mining. The use of water for recreation is also discussed.

Regional Development

R432.0020 Bodhaine, George L. "Role of Water in the Pacific Northwest," *Journal of the American Water Works Association,* Vol. 57, No. 8 (August 1965), 973-980.

This study represents one component of the Pacific Northwest Economic Base Study sponsored by the Bonneville Power Administration. The specific objectives of this study were to: (1) analyze and describe briefly the major elements of the regional hydrologic system and the relations of those elements to each other and to the supplies of water available for man's use; (2) determine and compare the quantities of fresh water available and the water requirements in subareas of the region, as of 1960, (3) determine if the water supplies in the Pacific Northwest will be adequate to satisfy requirements to the year 2010.

R432.0040 California. "Legislative Analyst" *Economics of a State Water Resources Program.* July 9, 1957.

R432.0060 Council of State Governments, Southern Land Economics Research Committee, and the Agricultural Policy Institute at North Carolina State University. *Water Resources and Economic Development in the South.* A Series of Papers presented at the Conference on Water Resources and Economic Development in the South. March 1965.

The papers presented at the conference discuss the following subjects: (1) the problems of economic development in the South as they relate to water resources, (2) the potentialities for contribution of social science research to solve these problems, and (3) how to organize for this contribution in an interdisciplinary setting.

R432.0068 Hawaii. Department of Land and Natural Resources, Division of Water and Land Development. *A Water Development Plan for South Kohala-Hamakua, Island of Hawaii.* January 1965.

R432.0069 Hawaii. Department of Land and Natural Resources, Division of Water and Land Development. *Kokee Water Project.* Island of Kauai, Hawaii, 1964.

A report on the feasibility of Water Development.

R432.0080 Snyder, J. Herbert. "The California Court Reference Procedure–Economics and Law in the Allocation of Ground Water," *Land Economics,* Vol. 33, No. 4 (November 1957), 287-303.

This report reviews certain aspects of the Court Reference Procedure that are of interest to both students of law and economics. It is intended to show that the Court Reference Procedure may be used as an effective overall means for allocating groundwater rights. A comparison of the California procedure is made with legal provisions of 17 selected western states.

R432.0100 Western Agricultural Economics Research Council. *Water Resources and Economic Development of the West.* Proceedings of the Water Resources Development Committee . . . Report No. 1: "Research Needs and Problems," Western Agricultural Economics Research Council, Berkeley, California, 1953.

Economic analysis of water resource policies, p. 21-48; Evaluation of secondary benefits of water-use projects, p. 49-62.

EVALUATION PRACTICES

R440.0020 Altouney, Edward Gregory. *The Role of Uncertainties in the Economic Evaluation of Water-Resources Projects.* Institute of Engineering-Economic Systems, Report EEP-7. Stanford University, Stanford, California, August 1963.

This study assesses the reliability of the values of net benefits and the benefit-cost ratio presented to decision-makers as criteria for decision when both the preliminary cost and benefit estimates are subject to large errors. A method by which the uncertainty of the benefit-cost analysis can be quantified is demonstrated.

R440.0040 Anderson, Jerome F., "Objectives, Criteria and Methodology," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 255-260.

R440.0060 Castle, Emery, Kelso, Maurice, and Gardner, Delworth. "Water Resources Development: A Review of the New Federal Evaluation Procedures," *Journal of Farm Economics,* Vol. 45, No. 4 (November 1963), 693-704.

This paper reviews a statement submitted by the Secretaries of the Army, Interior, Agriculture, and Health, Education, and Welfare to President Kennedy at his request. They reviewed existing principles, standards, and procedures currently being used, and made appropriate recommendations in view of the need for an up-to-date set of standards, for the formulation and evaluation of water resources projects. The authors, then, assess the economic consequences of the new statement of policy and examine the economic rationale underlying the recommendations. An appendix is also provided to give a chronology of events leading up to the statement.

R440.0080 Eckstein, Otto. *Water Resource Development: The Economics of Project Evaluation.* Cambridge, Massachusetts. Harvard University Press, 1958.

Benefit-cost criteria for the evaluation of water resource development projects are developed. Procedures for application of these criteria to various types of projects are given. Historical and political aspects of project selection are discussed.

R440.0100 Fox, Irving K. and Herfindahl, Orris C. "Attainment of Efficiency in Satisfying Demands for Water Resources," *American Economic Review,* Vol. 54 (May 1964), 200-206.

What constitutes an efficient allocation of productive services depends on the objectives of the system. Our discussion is confined to the problem of how an efficient allocation of water resource investment can be approached more closely, given that the objective is to increase national income. The subject of this paper is a large one and numerous studies bear upon it, but our treatment must, of necessity, be limited in scope. Therefore, we have restricted ourselves to an assessment of the results of existing practices within the Federal government upon efficiency. This we seek to do by (1) Examining certain key Federal policies which bear on efficiency. (2) Analyzing certain features of 178 reports on projects authorized in 1962 by the Congress for construction by the Corps of Engineers. These projects involve an initial capital investment of about 3 billion dollars. (3) Comparing in a limited way the Corps projects authorized in 1962 with Corps projects authorized in 1950. (Authors)

R440.0120 Haveman, Robert H. *Water Resource Investment and the Public Interest, An Analysis of Federal Expenditures in Ten Southern States.* Nashville, Tenn., Vanderbilt University Press, Nashville, 1965.

Examines the benefit-cost ratio problem with a series of concrete criteria and formulae and demonstrates that the present system of computing benefit-cost ratios is inaccurate and misleading. Excerpt in *Congressional Record,* December 24, 1963, v. 109, p. 25514-25519.

R440.0140 Hufschmidt, Maynard M., Krutilla, John, and Margolis, Julius. *Standards and Criteria for Formulating and Evaluating Federal Water Resources Development.* Report of Panel of Consultants to the Bureau of the Budget, Washington, D.C., June 30, 1961.

This report represents the views of a group of experts who were asked to present their independent judgments on suggested standards and criteria for formulating and evaluating Federal water resource developments. The following subjects are discussed: (1) the basic framework for water resources development, (2) the interest or discount rate, (3) secondary benefits, (4) risk and uncertainty, (5) alternative costs in evaluation of Federal hydroelectric projects, (6) recreation and fish and wildlife values, (7) financial policy, and (8) the investment decision process.

R440.0160 Jones, Robert E., Jr., *Economic Evaluation of Federal Water Resource Development Projects,* Report to the Committee on Public Works, House of Representatives, from the Subcommittee to Study Civil Works, 82nd Congress, 2nd Session, House Committee Print No. 24, December 5, 1952, Washington, D.C., U.S. Government Printing Office, 1952.

This report examines present practices and procedures used in economic evaluation of Federal water resource projects. The lack of consistency in these procedures is shown. Some specific Federal projects are discussed. The Subcommittee suggests that the benefit-cost ratio alone is not an adequate criterion, and examines some additional practices which could be used.

R440.0180 Krutilla, John V., "Columbia River Development: Some Problems of International Cooperation," *Land and Water: Planning for Economic Growth,* ed. Harold L. Amoss and Roma K. McNickle. Boulder, Colorado, Western Resources Conference, University of Colorado Press, 1961, p. 91-119.

This paper presents the progress of continuing research on the international aspects of Columbia River Development. Problems relating to the estimating of benefits to be shared are identified and discussed. Extreme values in the relevant range of possible responses to hydroelectric requirements are identified. System elements and the sequence of project introduction are evaluated to determine the effects of changes in variables on the relative economics of particular

projects. Results are applied to a comparison of the provisions of the U.S. Canadian treaty with the statement of principles of the International Joint Commission in terms of welfare economics.

R440.0200 Krutilla, John V. and Eckstein, Otto. *Multiple-Purpose River Development: Studies in Applied Economic Analysis.* Resources for the Future, Inc. Johns Hopkins Press, Baltimore, Maryland, 1958.

The purpose of this book is to help clarify some of the complicated problems involved in river basin development. Specifically, it seeks to detail the efficiency considerations involved in the development of river basins. Divided into two parts, the book establishes a model for analysis of river-basin development and then applies the analysis to two actual projects and one proposed project.

R440.0220 Leopold, Luna B. *Probability Analysis Applied to a Water-Supply Problem.* U.S. Geological Survey, Circular 410, Washington, D.C., 1959.

Probability mathematics were employed by Geological Survey hydrologists who concluded that practical gains obtained by building reservoirs on streams are limited, and that the limit may have already been reached and perhaps exceeded in some of the drainage basins of the western United States.

R440.0240 Margolis, Julius. "The Economic Evaluation of Federal Water Resource Development," *American Economic Review,* Vol. 49, No. 1 (March 1959), 96-111.

This article is a review of the following three books: "Water-Resource Development: The Economics of Project Evaluation," Otto Eckstein, Harvard University Press, Cambridge, Massachusetts; "Multiple Purpose River Development: Studies in Applied Economic Analysis," a Resources for the Future research study, J.V. Krutilla and Otto Eckstein, Johns Hopkins Press, Baltimore, Maryland, 1958; and "Efficiency in Government Through Systems Analysis With Emphasis on Water Resources Development," a RAND Corporation research study, R.N. McKean, John Wiley and Sons, New York, New York, 1958. The objectives of these three volumes were to suggest procedures by which to evaluate the efficiency of water resources development projects.

R440.0260 Marshall, Herbert. "The Evaluation of River Basin Development," *Law and Contemporary Problems,* Vol. 22, No. 2 (Spring 1957) 237-257.

This paper discusses the consideration of alternative uses of limited resources so that these resources may be allocated in such a manner as to yield the maximum satisfaction to members of society.

R440.0280 Marts, M.E. and Sewell, W.R.D. "The Application of Benefit-Cost Analysis to Fish Preservation Expenditures: A Neglected Aspect of River Basin Investment Decisions," *Land Economics,* Vol. 35, No. 1 (February 1959), 48-55.

The conflict of fish-versus-power is discussed in this article as one of the greatest obstacles to river basin development. The authors view this problem in the context of the contribution of fish and power to the total development of a given river basin rather than as two mutually exclusive and discrete alternatives. Attention is given to the economics of fish preservation.

R440.0300 McKean, Roland N. "Criteria for the Selection of Water Resource Projects," *Journal of the Operations Research Society of America,* Vol. 4, No. 1 (February 1956), 52-60.

The author states that the application of benefit-cost analysis, and related techniques of systems analysis and operations research, to the selection of water resource projects poses problems of formulating analyses and developing tests of preferredness. Several points relative to the solution of these problems are discussed and illustrated.

R440.0320 Owen, John P. and Zingler, Ervin K., "Economic Feasibility of Multipurpose Dams," *Studies in Business and Economics, No. 5.* Bureau of Business and Economic Research, College of Business Administration, University of Houston, Houston, Texas, 1958.

The purpose of this study is to develop sound and usable measurement concepts and techniques whereby the economic feasibility and justification of multiple-purpose projects can be determined. Techniques for measuring costs and benefits are emphasized.

R440.0340 Pyatt, Edwin E. and Rogers, Peter P. "On Estimating Benefit-Cost Ratios for Water Supply Investments," *American Journal of Public Health,* Vol. 52, No. 10 (October 1962), 1729-1742.

This article is concerned with the relationship of money value to municipal water supply improvements. A simplified approach is presented for ascertaining municipal water supply benefit-cost ratios for underdeveloped regions of the world. The authors' methodology is applied to Puerto Rico as an example.

R440.0360 Pyatt, E.E., *et al.* "Benefit Cost Analysis for Municipal Water Supplies," *Land Economics,* November 1964.

R440.0380 Rasmussen, Jewell J. "Economic Criteria for Water Development Projects," *Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers,* Vol. 82, No. IR2, (May 1956), 977-1, 977-14.

This article presents a brief survey of some of the criteria for determining the economic justification of water development projects. An adequate supply of water of satisfactory quality and conflicts in the use and development of water resources are some of the conditions which the author feels should be considered by national objectives.

R440.0400 Regan, M.M. and Greenshields, E.L. "Benefit-Cost Analysis of Resource Development Programs," *Journal of Farm Economics,* Vol. 33, No. 4 (November 1951), 866-880.

Those recommendations of a 1950 Water Resources Policy Commission report dealing with the economic evaluation of proposals for the development of water resources, are examined by the authors for purposes to be served by such evaluations. Problems in developing techniques and procedures used in such economic evaluations are also examined.

R440.0420 Renshaw, Edward F. "Appraisal of Federal Investment in Water Resources," *Modern Land Policy,* edited by H.G. Halcrow. Urbana,

Illinois, Land Economics Institute, University of Illinois, 1960.

The establishment of a theoretical framework from which one can view contemporary benefit-cost analysis within an economic context is discussed. Also, an attempt is made to analyze the bias inherent in the estimating procedures of one specific water resource agency, the Bureau of Reclamation, and thus demonstrate the way in which submarginal projects are justified as being in the public interest.

R440.0440 Renshaw, Edward F. *Toward Responsible Government: An Economic Appraisal of Federal Investment in Water Resource Programs.* Chicago, Idyia Press, 1957, 1957.

This book is a criticism of Federal water investment policies. The author reviews procedures of the Bureau of Reclamation, The Army Corps of Engineers, and the Department of Agriculture to evaluate benefits and costs of selected projects. He concludes that in virtually every case these analyses have been biased in favor of public investment by overstatement of project benefits and understatement of project costs.

R440.0460 Tolley, G.S. "Analytical Techniques in Relation to Watershed Development," *Journal of Farm Economics,* Vol. 40, No. 3 (August 1958), 653-665.

The role of objective estimation procedures in the evaluation of, and to some extent the planning of, small watershed developments is discussed.

R440.0480 Udall, Stewart L. "Development of United States Water Resources," *Journal of the American Water Works Association,* Vol. 54, No. 10 (October 1962), 1163-1172.

The nature of the nation's water resource problems are outlined and the Federal Government's programs to meet these problems are reviewed. The then-proposed Water Resources Planning Act is discussed, as are the Federal Water Pollution Control Act Amendments of 1961. The Delaware River Basin Compact is described and the role of the Federal Government in the plan is presented.

R440.0500 U.S. Department of Agriculture. *Multiple-Purpose Watershed Projects Under Public Law 566.* Soil Conservation Service, PA-575, Washington, D.C., May 1963.

This pamphlet describes how multi-purpose watershed projects can be instigated to become an effective means of dealing with land use and water problems in rural and urban communities. When organized as a project-type undertaking, under Public Law 566, small watershed projects protect, manage, improve, and develop water and related land resources.

R440.0520 U.S. Bureau of the Budget. *Reports and Budget Estimates Relating to Federal Programs and Projects for Conservation, Development or Use of Water and Related Land Resources.* Circ. No. A-47, Washington, D.C., December 31, 1952.

R440.0540 U.S. Bureau of the Budget. *Standards and Criteria for Formulating and Evaluating Federal Water Resources Development.* Report of a panel of consultants. Washington, D.C., Government Printing Office, 1961.

R440.0560 U.S. Congress. House. Committee on Public Works. *Economic Evaluation of Federal Water Resource Development Projects.* H.C. Print No. 24. 82nd Congress, 2nd Session, December 5, 1952.

R440.0580 U.S. Subcommittee on Benefits and Costs, Federal Inter-Agency River Basin Committee. *Proposed Practices for Economic Analysis of River Basin Projects.* Washington, D.C., Government Printing Office, May 1950.

This report presents the conclusions and recommendations resulting from a series of studies by the Subcommittee on Benefits and Costs made for the purpose of developing acceptable procedures and principles for determining benefits and costs of water resource projects. The basic assumptions and principles involved in benefit-cost analysis are discussed, and the standards, problems, and procedures involved in the measurement of benefits and costs are considered. The application of principles and procedures for analysis are discussed in terms of several project purposes including irrigation, flood control, watershed treatment, navigation, electric power, recreation, and fish and wildlife. The application of benefit-cost data in allocation of costs is also discussed.

R440.0600 U.S. *Proposed Practices for Economic Analysis of River Basin Projects.* Report to the Inter-Agency Committee on Water Resources by the Subcommittee on Evaluation Standards, May, 1958.

The Green Book. This is a second edition of the report of the same title of 1950 by the then Subcommittee on Benefits and Costs. It contains proposals on handling each area of cost-benefit analysis and recommends substituting cost-benefit analysis for all other methods of economic evaluation. It remains the classic work in the field of cost-benefit analysis, and as such should command the attention of all people interested in cost-benefit analysis.

R440.0620 U.S. Interagency Committee on Water Resources. *Proposed Practices for Economic Analysis of River Basin Projects.* Report by the Subcommittee on Evaluation Standards. Rev. May 1958. Washington, D.C., 1959.

R440.0640 U.S. President's Water Resources Council. *Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources,* Prepared under the direction of the . . Council, together with a statement by Senator Clinton P. Anderson. 87th Congress, 2nd Session, Senate Document 97. Washington, D.C., Government Printing Office, 1962.

Supersedes Bureau of the Budget Circular A-47.

R440.0660 U.S. President's Water Resources Council. *Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources.* Washington, Government Printing Office, May 29, 1962. And Supplement No. 1, *Evaluation Standards for Primary Outdoor Recreation Benefits.* June 4, 1964.

These publications present the policy suggested for adoption by the Secretaries of Army, Interior, Agriculture, and Health, Education and Welfare in the formulation of cost-benefit studies for water resources development. Rates are suggested for discounting future benefits and costs and ways of calculating them are given, and policies are suggested for formulating standard procedures for cost-benefit analyses.

R440.0680 Webster, Henry H. and Hagenstein, Perry R. "Economic Analysis of Watershed Management Decisions–What Sort of Guides for Land Managers?" *Journal of Forestry,* Vol. 61, No. 9 (September 1963), 631-634.

The economic considerations involved in land management for the purpose of changing the quality, quantity, and timing of water flows are discussed. The types of data and the difficulties in assembling the data required for an economic analysis of the least-cost, fixed-expenditure, and production-goal decisions are discussed.

R440.0700 Wengert, Norman. "The Politics of River Basin Development," *Law and Contemporary Problems,* Vol. 22, No. 2 (Spring 1957), 258-275.

This article discusses the characteristics of the processes by which problems encountered in river basin development are identified and solutions chosen, and of the environment within which these identifications and choices are made. It focuses on the decision-making process, and on the factors and forces influencing decision-making–in other words, the political process.

R440.0720 Western Agricultural Economics Research Council. *Water Resources and Economic Development of the West.* Proceedings of the Water Resources Development Committee . . . Report No. 3: "Benefit-Cost Analysis," Western Agricultural Economics Research Council, Berkeley, California, 1954.

Contents. – Current concepts and practices in benefit-cost analysis of natural resource development, by Mark M. Regan and John F. Timmons. The role of benefit-cost analysis in public resources development, by S.V. Ciriacy-Wantrup. – Discussion, by William E. Folz and Eugene L. Grant.

R440.0740 Whipple, William. "Economic Feasibility of Federal Power Projects," *Land Economics,* Vol. 38 (August 1962), 219-230.

Reviews progress in developing analytical principles for Federal hydroelectric projects and suggests further steps needed.

COSTING

R450.0020 Barbour, Edmund and Willard, David G. *A Method for Calculating Power and Municipal Water Rates for Payout Studies.* Denver, Colorado, U. S. Department of the Interior, Bureau of Reclamation, March 1963.

Payout studies demonstrate repayment of project costs over certain periods of time and at interest rates established by current policy and legislation. The method of preparation of a payout study presented in this paper uses compound interest and annuity tables to predict required rates within an accuracy of approximately one-hundredth of a mill per kilowatt hour of power or one hundredth of a cent per thousand gallons of water. This method saves considerable effort over the cut-and-try approach of making out several complete payout schedules in order to find the correct rate.

R450.0040 Bennett, N.B., Jr. "Cost Allocation for Multi-Purpose Water Projects," *American Society of Civil Engineers Journal, Irrigation and Drainage Division,* Vol. 82, No. IR2 (May 1956), 1-10.

R450.0060 Hazen, Richard. "Financing and Cost Allocation in Regional Water Supply Systems," *Journal of the American Water Works Association,* Vol. 50, No. 9 (September 1958), 1136-1156.

The material for this article has been assembled in connection with studies for a supply system to bring water from the Yadkin River to a number of North Carolina cities. This project would furnish water wholesale to the several cities, and each city would continue to distribute retail water. Financing and cost allocation of joint water supplies are illustrated by describing five water supply projects already in operation.

R450.0080 Hines, Lawrence G. "Role of Price in the Allocation of Water Resources," *Journal of the Sanitary Engineering Division,* Proceedings of the American Society of Civil Engineers, Vol. 86, No. SAI, Part 1, (January 1960), 15-28.

The author examines the price-cost function in the allocation and utilization of water resources. This paper presents analysis of the market valuation process, the factors affecting the determination of municipal water rates, and the shifts of costs that result from different water uses.

R450.0100 Howson, Louis R. "Revenues, Rates, and Advance Planning," *Journal of the American Water Works Association,* Vol. 52, No. 2 (February 1960), 153-161.

The author suggests that public water plants could do more advance planning for construction and financing. Authorizing water rates that allowed the financing of new construction from current revenues could reduce the indebtedness of the utilities and reduce the need for bond elections.

R450.0120 Joss, Alexander. "Repayment Experiences on Federal Reclamation Projects," *Journal of Farm Economics,* Vol. 27, No. 1 (February 1945), 153-167.

The author discusses repayment experience on Federal Reclamation Projects (as opposed to private ventures) because comparable data on these projects are more readily available and because it appears that future irrigation development will be financed largely by Federal funds. Some indication of why different projects have had different repayment experiences is brought out by a comparison of the repayment experience with the irrigation debt per acre and with the increase in the value of land due to irrigation.

R450.0140 Koenig, Louis. "Effects of Stimulation on Well Operating Costs and Its Performance on Old and New Wells," *Journal of the American Water Works Association,* Vol. 52, No. 12 (December 1960), 1499-1512.

It was decided, as a result of a nationwide survey of water well stimulation practice, to investigate the savings in operating costs effected by stimulation treatment, as well as to determine whether the age of the well has any

appreciable effect on the technical and economic performance of stimulation. This article sets forth the criteria used in both these investigations and the conclusions reached.

R450.0160 Linaweaver, F. Pierce, Jr. and Geyer, John C. "Use of Peak Demands in Determination of Residential Rates," *Journal of the American Water Works Association,* Vol. 56, No. 4 (April 1964), 403-410.

The allocation of plant investment for residential customers according to their domestic and sprinkling uses is discussed. Data on residential demands are presented to illustrate the principles involved, and various alternatives for developing equitable water rate schedules are outlined.

R450.0180 Marts, M.E. "Use of Indirect Benefit Analysis in Establishing Repayment Responsibilities for Irrigation Projects," *Economic Geography,* Vol. 32, No. 2 (April 1956), 132-138.

The progress which has been made in the measuring of indirect benefits is briefly reviewed and avenues of further exploration are suggested. An investigation of the relationship between direct and indirect benefits in the retail trade area surrounding Payette, Idaho, an area dependent upon irrigation agriculture, is described and subsequent Payette-type studies are discussed. The meaningfulness of such benefit factors as a basis for decision-making is discussed in terms of project justification.

R450.0200 "Fundamental Considerations in Rates and Rate Structures for Water and Sewage Works," *Ohio State Law Journal,* (Spring 1951), 226-255.

R450.0220 Patterson, W.L. "Comparison of Elements Affecting Rates in Water and Other Utilities," *Journal of the American Water Works Association,* Vol. 57, No. 5 (May 1965), 554-560.

Some of the pertinent elements that may cause utility rates to change are discussed, with some demonstration of the differences in utility growth, investment, and revenues.

R450.0240 Ransmeier, Joseph Sirera. *The Tennessee Valley Authority.* Nashville, Tennessee, The Vanderbilt University Press, 1942.

One of the more controversial issues of the controversial Tennessee Valley Authority power program has been joint cost allocation. A purpose of the present study is to contribute to a clearer conception of this problem. The author hopes that this volume may also have a broader significance than the issue of cost allocation.

R450.0260 Renshaw, Edward F. "Value of an Acre-Foot of Water," *Journal of the American Water Works Association,* Vol. 50, No. 3 (March 1958), 303-309.

The article states that the demand for various types of water has been the subject of several studies. An attempt is made to summarize information on values of water in such a way that comparisons can be made within and between seven water use categories.

R450.0280 Rynders, A. and Becker, Elmer W. "What the Water Works Dollar Buys," *Water Works Engineering,* Vol. 114, No. 6 (June 1961), 541-545.

This article breaks down by percentages the money spent for water facilities. A table is included which itemizes capital expenditures for construction for the year 1958.

R450.0300 Stanford Research Institute. *Economic Considerations in the Formulation and Repayment of California Water Plan Projects.* A Report to the Haynes Foundation. Los Angeles, Stanford, California, Stanford Research Institute, March 1958.

R450.0320 U.S. Congress. House Committee on Public Works. *Allocation of Costs of Federal Water Resource Development Projects.* H.C. Print No. 23. 82nd Congress, 2nd Session, December 1952.

R450.0340 Welmon, William C. "Utility Depreciation Problems and Procedures," *Journal of the American Water Works Association,* Vol. 53, No. 4 (April 1961), 413-420.

The author discusses depreciation as it affects water utilities. The recognition of replacement depreciation for tax purposes and in the determination of rates would permit utilities to recover cost in the same manner that unregulated business recovers its costs. The author suggests modernizing the present depreciation procedures.

OTHER

R460.0020 Angell, Lester W., "Engineering, Geology, and Cost Studies," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 227-241.

R460.0040 Bower, Blair T. "Some Physical, Technological, and Economic Characteristics of Water and Water Resource Systems: Implications for Administration," *Natural Resources Journal,* Vol. 3, No. 2 (October 1963), 215-238.

This article attempts to show the interrelations among physical, technological, economic, and administrative facets of water resources. The author indicates that alternative ways of meeting needs for water and water related projects–such as flood plain zoning, waste treatment plants, in-plant recirculation, and changing uses of existing supplies–are becoming increasingly important. The type of administrative agency needed to meet the physical, economic, and technological needs of water and water resource systems is described.

R460.0060 Ciriacy-Wantrup, S.V. and Smith, Stephen C. (eds.). *Economics of California's Water Development.* Committee on Research in Water Resources, University of California, Berkeley, February 1958.

Although this document primarily discusses problems from California's point of view, the analyses presented are of interest to a wider audience. Among the subjects discussed are: (1) economic growth and water demand, (2) water allocation, (3) project evaluation, and (4) economics and planning.

R460.0080 DeHaven, J.C., Gore, L.A. and Hirshleifer, Jack. *A Brief Survey of the Technology and Economics of Water Supply.* The RAND Corp., Santa Monica, Calif., October 1953.

R460.0100 Eckstein, Otto and Krutilla, John V. "The Cost of Federal Money, Hells Canyon, and Economic Efficiency: Part I." *National Tax Journal,* Vol. 11, No. 1, March 1958.

The authors document the methodology by which they calculated what they feel is the cost of Federal money. The cost of capital is calculated with two models where the money invested in the Federal project may have alternatively provided: (1) a tax cut stimulating consumption, and (2) a tax cut stimulating investment.

R460.0120 Eckstein, Otto and Krutilla, John V. "The Cost of Federal Money, Hells Canyon and Economic Efficiency, Part II," *National Tax Journal.* Vol. 11, No. 2 (June 1958), 114-128.

In this study the authors have assessed the social costs of investment funds raised by Federal taxation, by discriminating carefully as to the probable sources from which they would be drawn in a particular historical context, and estimating the value of returns foregone in the private sector by diversion of funds to the water resources field. This approach yields a substantially different estimate of the opportunity cost of Federal investment funds from that developed by the conventional practice.

R460.0140 Geyer, John C., Wolff, Jerome B. and Linaweaver, F.P., Jr. *Final and Summary Report on Phase One of the Residential Water Use Research Project.* Baltimore, Maryland, Department of Sanitary Engineering and Water Resources, The Johns Hopkins University, October 1963.

This is a final report on Phase I of the Residential Water Use Research Project. Residential water use, peak hourly design criteria, commercial water use, and coincident water and sanitary sewage flows are discussed. This study was confined to the Baltimore metropolitan area; however, many of the results of the field studies and methods of analyses have general application.

R460.0160 Hudson, H.E. "Study of Domestic Water Use–Task Group Report," *American Water Works Association.* Vol. 50, No. 11 (November 1958), 1408-1418.

The article summarizes work of the Water Use Task Group which has been; assembly of detailed information from specific communities on peak demands; collection of long-term data on peak demands and residential sales from a group of privately owned water utilities; and collection and analysis of data from cities covered by a survey of operating data on residential water sales. This article is a summary of the work done in the year previous to publication of the article.

R460.0180 Picton, Walter L. *Water Resources Developments, Capital Investment Values, 1900-1975.* U.S. Department of Commerce, Business and Defense Services Administration, Washington, D.C., June 1959.

This study was made to provide water resources planners with statistical benchmarks as a basis for present and future planning in the several categories of water use. Included are estimates of capital investment and of the rate at which this capital was provided, and a projection of future requirements in a form that may be adapted to any region. This article also appears in the *Journal of the American Water Works Association,* Vol. 51, No. 10, October 1959, pp. 3-4, 9-11, under the title "Investment in Water Projects, 1900-1975".

R460.0200 Sokal, Daniel and Cook, E.F. "State Programs in Water-Resources Investigation," *Ground Water,* Vol. 2, No. 4 (October 1964), 9-13.

This report describes the types of activities included in an investigational program of 81 state agencies involved in regulating and controlling the use of both groundwater and surface water. Scopes of activities include observation-sell measurement, stream gaging, area investigation, site investigation, statewide compilation, drilling test wells, cooperation with the U.S. Geological Survey, providing geologic support for hydrologic investigations, basic research, studying special problems, and publishing hydrologic reports.

R460.0220 Taylor, William Warthin. *Cold Water on Salt Water.* P-546-RC. The RAND Corp., Santa Monica, Calif., July 16, 1954.

The author summarizes the essential points made in an earlier RAND Corporation report entitled 'A Brief Survey of the Technology and Economics of Water Supply' by J.C. DeHaven, L.C. Gore, and J. Hirshleifer. The economics of salt water conversion are explored. It is concluded that conservation, redistribution, and reclamation of water are measures that have not been fully exploited and which are far less expensive than salt water conversion.

R460.0240 Wilson, Walter T., "Hydrologic and Climatologic Studies," *Organization and Methodology for River Basin Planning,* ed. Carl E. Kindsvater. Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, p. 199-213.

WELFARE

General – Theory

W000.0020 Baumol, W.J. *Welfare Economics and the Theory of the State.* London, Longmans, Green, 1952, Chapter 12, p. 140-157. Also, Cambridge, Mass., Harvard University Press, 1965.

This chapter demonstrates the ancient lineage of an economic theory of government action based on a distinction between private and public costs and benefits. A number of classical economists (Smith, Storch, Say, McCulloch, Mill, Sidgewick, etc.) so defended the provision of education by the state. See also L. Robbins, *The Theory of Economic Policy in English Classical Political Economy.* London, Macmillan, 1952, pp. 89-93. (M. Blaug)

W000.0030 Bowen, Howard R. *Toward Social Economy.* New York, Rinehart and Company, 1948.

W000.0040 The Brookings Institution. *Can Benefits and Costs of Public Investments Be Measured?* Brookings Research Report No. 32. Washington, D.C., Brookings Institution n.d.

A summary of *Measuring Benefits of Government Investments* edited by Robert Dorfman.

W000.0070 Cazes, Bernard. *International Trade Union Seminar on Economic and Social Programming.* Final Report. Paris, Organization for Economic Cooperation and Development, September 1964.

W000.0074 "Three Systems Analysis of Social Problems in California Now in Federal Hands," *Chemical and Engineering News,* Vol. 43, No. 34 (October 1965).

W000.0080 Colm, Gerhard and Helzner, Manuel. "Financial Needs and Resources Over the Next Decade: At All Levels of Government," *Public Finances: Needs, Sources and Utilization,* Universities-National Bureau for Economic Research. Princeton, N.J., Princeton University Press, 1961, p. 3-21.

W000.0100 Committee for Economic Development. *CED in 1965–The Vital Issues in A Nation of Many Goals.* A report of Activities in 1965. New York, Committee for Economic Development, March 1966.

W000.0120 Davis, Otto A. and Whinston, Andrew B. "Welfare Economics and the Theory of Second Best," *Review of Economic Studies,* Vol. 32 (January 1965), 1-14.

W000.0140 Eckstein, Otto. *Public Finance.* Englewood Cliffs, New Jersey, Prentice-Hall, 1964.

W000.0160 Eckstein, Otto, "A Survey of the Theory of Public Expenditure Criteria," *Public Finances: Needs, Sources and Utilization,* by Universities–National Bureau for Economic Research. Princeton, N.J., Princeton University Press, 1961, p. 439-504.

The theory of expenditure criteria has received a lot of attention in recent years, stimulated by the practical needs of the world. In the United States, the evaluation of public works, particularly in the field of water resource development, has led to the evolution of techniques and criteria for project evaluation. This work was largely pioneered within the Federal government. The need for devising development plans for underdeveloped countries has led to extensive theoretical study of investment criteria for that particular economic context.

This paper presents the elements of the theory. Rather than propose or defend specific criteria, I try to indicate the issues about which assumptions must be made. First, possible objective functions are discussed–What, if anything, is to be maximized? There follow sections on constraints, interest rates, repercussion effects, and the treatment of risk and uncertainty. Finally, with the taxonomy of the problem in hand, most of the more important decision-models that have been developed are surveyed and discussed (Author)

W000.0171 Hawaii. Department of Labor and Industrial Relations, Research and Statistics Office. *A Case for an Automatic Increase in the Unemployment Insurance Maximum Weekly Benefit Amount.* May 1965.

W000.0172 Hawaii. Department of Taxation, Tax Research and Planning Office. *Effectiveness of Tax Relief for Natural Disaster Victims.* March 12, 1964.

W000.0180 "Opportunity Knocks," *Economist,* Vol. 217 (December 25, 1965), 1428.

W000.0200 Gardner, John. *Goals for America.* Englewood Cliffs, N.J. Prentice-Hall, 1960.

W000.0210 Gordon, M.S. (ed.). *Poverty in America.* San Francisco, Calif., Chandler Publishing Company, 1965.

The current poverty debate in America cuts across a number of issues in the economics of education: the educational characteristics of the unemployed, the payoff from training and retraining, manpower forecasting as a method of preventing poverty, and the like. This volume will introduce the reader to the discussion. See, particularly, R.A. Gordon, 'An Economist's View of Poverty', pp. 3-12, H.P. Miller, 'Changes in the Number and Composition of the Poor', pp. 81-102, R.J. Lampman, 'Income Distribution and Poverty', pp. 102-115, H.P. Minsky, 'The Role of Employment Policy', pp. 175-201, M.S. Gordon, 'Poverty and Income Maintenance for the Unemployed', pp. 253-265, K. Davis, 'Some Demographic Aspects of Poverty in the United States', pp. 299-322, and F. Machlup, 'Strategies in the War on Poverty', pp. 445-465. See also B.A. Weisbrod's introduction to *The Economics of Poverty: An American Paradox.* Englewood Cliffs, N.J., Prentice-Hall, 1965, pp. 1-28. (M. Blaug)

W000.0220 Kafoglis, Milton. *Welfare Economics and Subsidy Programs.* University of Florida Monographs, Social Sciences, No. 11, Gainesville, Fla., University of Florida Press, Summer 1961.

This paper attempts to define intangible benefits by asking whether the 'benefit' is in fact a cost to someone. It discusses criteria to distinguish between user and non-user benefits and costs and cautions against double counting. Cost-benefit analysis is discussed for mixed government-private industry projects, for projects involving income-redistribution, and for highway taxing. Most importantly, the propriety of using market or benefit pricing, income redistribution, and user-tax philosophies in estimating benefits is discussed.

W000.0240 Kaser, M.C. "Needs and Resources for Social Investment," *International Social Science Journal,* No. 3 (1960), 409-443.

Report of a Carnegie Endowment Study Group (1959, Geneva, Switzerland) of which the author was Secretary. The literature on the assessment of social investment, chiefly on health, education and social security, was analyzed (extensive bibliographic footnotes), the characteristics of social returns was defined, and proposals made for the measurement of costs and benefits in the form of three frames, viz., levels of development ('outputs'), structure of stocks ('capital'), and balance of expenditure ('inputs'). See, for a subsequent examination of these concepts, J. Vaizey, *The Economics of Education,* London, Faber and Faber 1962, p. 66-69.

W000.0260 Lampman, R.J. "Towards an Economics of Health, Education, and Welfare," *Journal of Human Resources,* (Summer 1966), 45-54.

The author sketches a framework to integrate work on health, education, and welfare. (M. Blaug)

W000.0280 Lewis, W.A. "Consensus and Discussions on Economic Growth: Concluding Remarks to a Conference," *Economic Development and Cultural Change,* October 1957, p. 75-80.

Touches briefly on education and concludes that no consensus emerged during the conference on the priority of education among social expenditures or on the priority of certain types of education as against others. (M. Blaug)

W000.0300 Mishan, E.J., "A Survey of Welfare Economics, 1939-1959," *Surveys of Economic Theory,* Volume I, ed. E.A.G. Robinson, New York, St. Martin's Press, 1965, pp. 154-222. Also in *Economic Journal,* Vol. 70 (June 1960), 197-265.

W000.0340 Pigou, A.C. *The Economics of Welfare.* London, Macmillan, 1948.

W000.0360 Rothenberg, Jerome. *The Measurement of Social Welfare,* Englewood Cliffs, New Jersey, Prentice-Hall, 1961.

Focuses on the nature of the fundamental criterion needed for analysis relevant to public policy decisions.

W000.0371 Scott, Norman, "The Planning and Cost-Benefit Analysis of Social Investments," *International Institute for Labour Studies Bulletin, No. 2.* February 1967.

W000.0377 "Systems Engineers Tackle Social Problems: California Studies/$400,000 Footnote or a New Direction for the Industry? *Space/Aeronautics,* Vol. 44 (November 1966), 18-20.

W000.0380 Thurlow, L.C. "The Causes of Poverty," *Quarterly Journal of Economics,* (February 1967), 39-57.

An econometric analysis of the causes of poverty in the United States which shows that education alone will significantly reduce the incidence of poverty in future years. The article closes with some important comments on the ambiguous policy implications of the study. (M. Blaug)

W000.0400 Universities–National Bureau Committee for Economic Research. *Public Finances: Needs, Sources and Utilization.* Princeton, N.J., Princeton University Press, 1961.

Contents: 'Financial Needs and Resources Over the Next Decade: At All Levels of Government' by G. Colm and M. Helzner; 'Financial Needs and Resources Over the Next Decade: State and Local Governments' by Dick Netzer; 'An Economic Theory of Fiscal Decentralization' by C.M. Tiebout; 'Approaches to Fiscal Theory of Political Federalism' by R.A. Musgrave; 'Practical Solutions to Financial Problems Created by the Multilevel Political Structure' by L.L. Ecker-Racz and I.M. Labovitz; 'Metropolitan Finance Problems: Territories, Functions, and Growth' by Julius Margolis; 'Decision-Making in Taxation and Expenditures' by C.E. Lindblom; 'Evaluating Alternative Expenditure Programs' by R.N. McKean; 'Defense Planning and Organization' by A.C. Enthoven and H.S. Rowen; 'User Prices vs. Taxes' by O.H. Brownlee; 'A Survey of the Theory of Public Expenditure Criteria' by Otto Eckstein.

Benefits of Welfare

W010.0010 Arrow, Kenneth J. *Criteria for Social Investment.* Paris, Organization for Economic Cooperation and Development, 16 August 1963.

The author discusses the problems of calculating the benefits deriving from acts of social investment, concluding with a brief examination of these problems in the context of educational investment.

W010.0020 Dorfman, Robert (ed.). *Measuring Benefits of Government Investments.* Papers presented at a conference of experts held November 7-9, 1963. Washington, D.C., Brookings Institution, 1965.

This almost classical anthology of cost-benefit analysis consists of papers on various aspects of government investment and each paper is abstracted separately in this bibliography.

W010.0040 Feldstein, Martin S. "Net Social Benefit Calculations and Public Investment Decisions," *Oxford Economic Papers,* March 1964.

W010.0060 Fishman, Leo (ed.) *Poverty Amid Affluence.* West Virginia University Conference on Poverty Amid Affluence, 1965. New Haven, Yale University Press, 1966.

Public approaches to minimize poverty, by Theodore W. Schultz, p. 165-181; Strategies in the war against poverty, by Otto Eckstein, p. 200-211; Ends and Means in the War Against Poverty, by Robert J. Lampman, p. 212-230.

W010.0080 Gallaway, Lowell E., "An Economic Analysis of Public Policy for Depressed Areas," *Industrial and Labor Relations Review,* Vol. 15 (July 1962), 500-509.

Discusses criteria justifying Federal aid to depressed areas, giving particular attention to the problem of establishing the existence of inequities in the distribution of benefits and costs of economic growth, as between depressed areas and the rest of the economy.

W010.0090 Kaser, M.C. *The Analysis of Costs and Benefits of Social Programmes.* Paper presented to the European Expert Group on Problems and Methods of Social Planning, (November 1963, Dubrovnik, Yugoslavia). Geneva, United Nations Office of Social Affairs, European Office of the United Nations, 26 August 1963.

The paper defines cost-benefit; the effect of chance upon the benefits and of 'game' strategy among those making the decision are relevant to social planning but require other forms of analysis. It contrasts the reduction of benefits to money measure (discounted cash flow) in business decisions with the heterogeneity of social returns. A way

of systematizing the choice between variables on different scales is proposed in the form of a three-dimensional matrix. An Appendix discusses the possible interactions between the constituents of the 'output' frame, a triangular matrix of 23 variables.

W010.0100 Krutilla, John V. "Criteria for Evaluating Regional Development Programs," *American Economic Review,* Vol. 45 (May 1955), 120-132.

W010.0120 Margolis, Julius. "Secondary Benefits, External Economics, and the Justification of Public Investment," *The Review of Economics and Statistics,* Vol. 39, No. 3 (August 1957), 284-291.

This article discusses the formulations of secondary benefits derived from projects of the Bureau of Reclamation. Arguments for the justification of expenditure of public funds are presented.

W010.0140 Maryland Society for Mentally Retarded Children. *Life Time Plan for the Retarded (A).* Baltimore, Maryland, Maryland Society for Mentally Retarded Children, 1965.

W010.0170 McCamman, Dorothy. *Measuring Income Security of the Aged.* Baltimore, Md., Social Security Administration, Division of Program Research, 1959.

W010.0180 Schultz, T.W., "Public Approaches to Minimize Poverty," *Poverty Amid Affluence,* ed. L. Fishman. New Haven, Conn., Yale University Press, 1966, p. 165-181.

A broad treatment of the poverty problem, extending the argument of Schultz's 'Investing in Poor People,' *American Economic Review,* May 1965, p. 510-520. (M. Blaug)

W010.0200 Sieder, Violet. *Study of Area Projects of the Baltimore Youth Commission.* Baltimore, Md., Community Chest and Council of America, 1949.

The Baltimore Youth Commission, concerned with controlling and eliminating juvenile delinquency, recognized that the problem involved not only the behavior of youth, but the adequacy of services and the attitude of the community. Area projects were initiated as one method of attacking the problem which would offer a double barrelled approach by attempting in selected areas of the city: first, to arouse the citizenry to awareness and action about conditions contributing to delinquency; and second, to provide services to meet the needs of the young people.

The purpose of this study is to assess the value of this experiment in order to determine whether it should be continued, and if so, in what form. The Study Committee recognized that the wartime crisis of juvenile delinquency was past. It therefore agreed to appraise the Area Projects in terms of their long term value for promoting and maintaining community welfare rather than to look only at the results in terms of the original and more limited objectives. (Author)

W010.0220 U.S. Department of Agriculture. *Revenues and Expenditures of State and Local Governments in the Great Plains.* Washington, D.C., U.S. Department of Agriculture, 1963.

W010.0240 U.S. Congress, House. *The Civil Functions Program of the Corps of Engineers, United States Army,* H.C. Print No. 21. 82nd Cong., 2nd Sess., December 5, 1952.

W010.0260 U.S. Department of Health, Education, and Welfare, Welfare Administration, Children's Bureau. *A Study and Assessment of Maryland's Program and Facilities for the Treatment and Control of Juvenile Delinquency,* Washington, D.C., 1967.

This study disclosed problems which are related to lack of uniformity in the laws governing juvenile causes; lack of sufficient trained personnel at all levels; and an overuse of institutionalization, particularly by Baltimore City, which has created population pressure in all facilities for delinquent juveniles. (Author)

W010.0280 United States. Office of Opportunity. *Planning Programs for the Reduction of Poverty. A Design for Study of the Community Action Program of Baltimore, Maryland.* The Institute for Environmental Studies of the University of Pennsylvania, The Urban Studies Institute of Morgan State College, and Kettelle Associates, Inc., February 1967.

An exhaustive and comprehensive evaluation of the integrated social service programs of the city of Baltimore, this paper and its accompanying appendices examine the total problem of a city's social services and includes an explanation of the application of the analytical techniques of operations research to this problem. The paper discusses political factors, the anti-poverty program, housing, employment, population, juvenile delinquency, health, citizen participation, and includes a study of a small group of case histories.

Cost Control of Welfare

W020.0020 Arnion, J., "Costs and Efficiency of Health and Social Welfare Institutions," *Cost-Benefit Analysis of Social Projects,* Geneva, United Nations Research Institute for Social Development, April 1966.

Efficient hospital organization and administration is found to demand cost-benefit studies. Opposition to such studies is to be expected from people who do not understand the need for efficiency when planning welfare services.

W020.0040 Beesley, M.E. and Foster, C.D. "The Victoria Line: Social Benefit and Finances," *Journal of the Royal Statistical Society.* Series A, Vol. 128, No. 1, (1965), 67-88.

W020.0060 Capron, William M. *The Potential Role of Cost Effectiveness Analysis for Evaluation of Government Domestic Programs.* An address before the Symposium on Cost-Effectiveness Analysis, Institute for Defense Analysis, Arlington, Va., June 15, 1965.

W020.0080 Carlin, Alan. *The Grand Canyon Controversy: Lessons for Federal Cost-Benefit Practices.* P-3505. The RAND Corporation, Santa Monica, California, February 1967.

This is a criticism of the cost-benefit methods used in the Grand Canyon debate.

W020.0100 Chamberlain, Neil W. "Government Investment: How Scientific Can It Be?," *Challenge*, Vol. 14, (July-August 1966), 32-35.

W020.0120 Cotner, Melvin L. "Criteria and Problems in the Use of Quantitative Analytical Procedures for Public Development Investments," *Journal of Farm Economics*, Vol. 44, No. 4 (November 1962), 1085-1092.

This paper suggests criteria that may be useful to public administrators in selecting analytical tools for watershed planning. In addition, some of the problems of adapting the analytical procedures to the realities of public development proposals are discussed.

W020.0140 Enke, Stephen. "The Economic Aspects of Slowing Population Growth," *Economic Journal*, Vol. 76, (March 1966), 44-56.

Argues that economic resources devoted to reducing population growth are more effective in raising per capita income in underdeveloped areas than are the same resources applied to accelerating production, and estimates the cost of an adequate birth control program.

W020.0160 Exton, Elaine. "Here's How HEW Applies Planning-Programming-Budgeting System," *American School Board Journal*, Vol. 153 (December 1966) 5-7.

W020.0180 Feldstein, Martin S. "Cost-Benefit Analysis and Investment in the Public Sector," *Public Administration*, Vol. 42 (Winter 1964), 351-372.

W020.0200 Gertel, Karl. "Recent Suggestions for Cost Allocation of Multiple-Purpose Projects in the Light of Public Interest," *Journal of Farm Economics*, Vol. 33, No. 1 (February 1951) 130-134.

This report discusses some proposed recommendations on how to allocate multi-purpose project costs on an equitable basis. The author points out that the allocation of joint costs among the various services provided by multi-purpose projects continues to be one of the more controversial issues in the economic analysis of water resource development programs.

W020.0220 Gorham, William. "Allocating Federal Resources Among Competing Social Needs," *Health, Education, and Welfare Indicators*, August 1966, p. 1-13.

The Assistant Secretary for Program Coordination, Department of Health, Education, and Welfare, discusses the problems of measuring and evaluating the output of HEW programs.

W020.0240 Grosse, Robert N., "Cost-Benefit Analysis and Social Planning." Speech, presented at the Second Cost-Effectiveness Symposium, Washington, D.C., March 13-14, 1967.

W020.0260 Hansen, Niles M. "Some Neglected Factors in American Regional Development Policy: the Case of Appalachia," *Land Economics*, Vol. 42 (February 1966), 1-9.

Argues that the Appalachian Regional Development plan overemphasizes expenditures on economic overhead capital, since considerations of opportunity cost and labor mobility have been neglected.

W020.0280 Krutilla, John V. "Welfare Aspects of Benefit-Cost Analysis," *Journal of Political Economy*, Vol. 69, No. 3 (June 1961), 226-235.

The author characterizes benefit-cost analysis as the collection and organization of data relevant by some meaningful criteria to determining the relative preferredness of alternatives. Welfare considerations in its application to governmental expenditures for resource development are discussed.

W020.0300 Levine, Abraham S. "Cost-Benefit Analysis and Social Welfare," *Welfare in Review*, Vol. 4 (February 1966), 1-11.

Explores possible applications of cost-benefit analysis in evaluating social welfare program expenditures.

W020.0320 Levine, Abraham S. "Cost-Benefit Analysis of the Work Experience Program," *Welfare in Review*, Vol. 4 (August-September 1966), 1-9.

Outlines the "basic principles underlying an optimal research strategy" for a cost-benefit analysis of the Aid to Families with Dependent Children program.

W020.0340 Levine, Robert A. "Systems Analysis in the War on Poverty." Office of Economic Opportunity, paper presented to the Operations Research Society of America, May 19, 1966.

W020.0360 Lichfield, N. and McKean, R. "Costs and Benefits from Different Viewpoints," *Public Expenditure Decisions in the Urban Community*, ed. H.G. Schaller. Washington, Resources for the Future; distributed by the Johns Hopkins Press, Baltimore, 1963.

W020.0380 MacDonald, John S. *Benefit Cost Analysis of Social Welfare Programs.* 17th Annual Proceedings of the Industrial Relations Research Association, Madison, Wisconsin, 1965.

W020.0400 Marglin, Stephen A. *Public Investment Criteria.* Cambridge, Mass., Massachusetts Institute of Technology Press, 1966.

The point of departure for this essay has been that for benefit-cost analysis to serve an effective and useful role in the implementation of planned economic development, the multi-policy goals of public policy must be explicitly reflected in the standards and criteria that govern public investment. It is of secondary importance and purely a matter of planning convenience whether the multiplicity of goals is reflected in the form of explicit weights on the contribution of public sector programmes to specific objectives of public policy or in the form of constraints on programme performance with respect to different goals. What matters is that no relevant objective of public policy is ignored or subordinated in an ordering that brings it to bear only if 'other things are equal'--which in the nature of the universe 'other things' never are.

Because objectives are not fully complimentary, policy-makers must make value judgments about their relative importance; these value judgments are reflected in public investment criteria in the shadow prices that replace

market prices in calculating benefits and costs. Project plan formulation ideally takes place in three stages: first, the national economic plan setting the broad strategy of development is elaborated; second, shadow prices–weights on objectives, rates of discount, and others–are derived from comparisons of the national plan with rejected alternatives; third, projects are designed to carry out the strategic decisions of the plan. It is in the first stage that policymakers' value judgments enter: by choosing one national economic plan over alternatives and designating it as the optimal plan. (Author)

W020.0440 Milliman, J.W. *Decision-Making for Public Investment: Discussion.* P-2252. The RAND Corporation, Santa Monica, California, January 1961. (DDC No. AD 634-200).

The report presents a critique on "Welfare Aspects of Benefit-Cost Analysis," by John M. Krutilla, and "Water and Welfare," by Robert Dorfman. In the light of these papers it comments on the RAND-sponsored study, *Water Supply: Economics, Technology, and Policy*, by Hirshleifer, De Haven, and Milliman (University of Chicago Press, 1960).

W020.0460 Peacock, Alan T. and Robertson, D.J., (eds.), *Public Expenditures: Appraisal and Control,* Edinburgh, Oliver and Boyd, 1963.

W020.0480 Peters, G.N. *Cost-Benefit Analysis and Public Expenditures.* Eaton Paper No. 8. Institute of Economic Affairs, 1966.

W020.0500 Scott, Norman, "Some Problems of Cost-Benefit Analysis of Social Investments," *Cost-Benefit Analysis of Social Projects.* Geneva, United Nations Research Institute for Social Development, April, 1966.

The problems involved in doing a cost-benefit analysis are discussed and the extra cost of using this decision-making tool are revealed. The author cautions that the decision to use cost-benefit analysis is in itself a cost administrative decision and should not be made by the economist alone.

Metropolitan

W030.0020 Ackoff, R.L. "Toward Quantitative Evaluation of Urban Services," *Public Expenditures in the Urban Community,* ed. Howard G. Schaller. Resources for the Future, Inc. Washington, D.C., 1962. Distributed by Johns Hopkins Press, Baltimore, Maryland, 1963.

W030.0040 Clendenen, Richard. *Blueprint for the Institutional Care and Treatment of Delinquent Children in Maryland.* Report to the Maryland State Department of Public Welfare, Baltimore, Maryland, 1957.

W030.0060 Health and Welfare Council of the Baltimore Area, Inc. *Plan for Action on the Problems of Baltimore Disadvantaged People (A).* Baltimore, Maryland, Health and Welfare Council of the Baltimore Area, Inc., 1964.

This is a very interesting report on a plan for a 'human renewal' project to parallel Baltimore's urban renewal projects. Among other problems it discusses neighborhood organization, library services, day-care for young children, homemaker services, a street club program, character-building youth services, consumer protection, legal services, training and education, sex education, supplemental education, police-community relations, and sanitation.

W030.0080 Health and Welfare Council of the Baltimore Area. *Social Welfare Planning in Baltimore City.* Baltimore, Maryland, Health and Welfare Council of the Baltimore Area, 1966.

This report to the Baltimore City Council contains reviews of the activities and budgets of the separate municipal welfare agencies and recommends that the various agencies be brought under a single over-all planning and budgeting system. Expected costs and benefits are compared with costs and benefits resulting from the present uncoordinated activities.

W030.0100 Hirsch, Werner Z. "Cost Functions of an Urban Government Service: Refuse Collection," *Review of Economics and Statistics,* Vol. 47 (February 1965), 87-92.

Attempts to relate the cost of a municipal service to the variables of quality and condition of the service.

W030.0120 Lazarus, Ralph. *Goals for Metropolitan Areas.* New York, Committee for Economic Development, 1966.

The objective of this study is to establish a set of goals for metropolitan areas–goals that point the way to making our cities increasingly better places in which to live, to work, and to realize personal and community aspirations. The study will examine such questions as: What are the goals of people in a metropolitan area for their economy and their way of life? How do business goals and the goals of various segments of the metropolitan area inter-relate? How can private enterprise, local governments, and voluntary associations reconcile conflicts among goals and provide the goods and services necessary to meet goals enjoying a consensus? Later work will deal with such obstacles as crime, narcotics addiction, disease, poverty, high unemployment in some groups, and discrimination, in an effort to see how these can be dealt with.

W030.0140 Margolis, Julius., "Metropolitan Finance Problems: Territories, Functions, and Growth," *Public Finances: Needs, Sources and Utilization,* by Universities-National Bureau for Economic Research. Princeton, N.J., Princeton University Press, 1961, p. 229-293.

Studies of local public finance are typically replete with such alarming terms as crisis, problems, and emergency. The spirit of urgency permeates them. The dismal prophecies, if drastic remedial steps are not taken, are of slum-ridden cities, inadequately educated future generations, traffic clogged and abandoned central business districts, water-thirsty cities, mass flights to less encumbered areas, and patronizing and unpopular intervention of the Federal government. Despite the fact that most of the nation's wealth is located in the metropolitan areas, a great part of the difficulties of local governments is attributed to their fiscal condition. Why, when the city is the focus of economic activity, its residents have a more than proportionate share of the national income, its property is far more valuable than the nonurban sectors, it is the market place where most transactions occur, its fiscal base is far greater than other parts of the nation, must its governments operate under crisis conditions? What are the sources of these crises? Are they becoming more critical? These are the questions of this paper. (Author)

W030.0160 Margolis, Julius (ed.). *The Public Economy of Urban Communities.* Papers presented at the second Conference on Urban Public Expenditures, held Feb. 21-22, 1964. Washington, Committee on Urban Economics of Resources for the Future, Inc., Baltimore, Johns Hopkins Press, 1965.

W030.0180 Vickrey, William W., "General and Specific Financing of Urban Services," *Public Expenditure Decisions in the Urban Community,* ed. Howard G. Schaller. Washington, D.C., Resources for the Future, Inc. Distributed by Johns Hopkins Press, 1963.

The financing of urban services by charging those who most benefit is discussed. Ways are suggested of dealing with the problems that arise in this area.

Foreign Programs

W040.0010 Andersen, Bent, "A Study of the Costs and Benefits of Measures for Substitute Permanent Employment for Persons Not Competitive in the Labour Market," *Cost-Benefit Analysis of Social Projects.* Geneva, United Nations Research Institute for Social Development, April, 1966.

The alternatives of passive public support of unemployables and of the provision of work at a wage under sheltered conditions are under continuing study. Cost-benefit analysis indicates that intangible benefits are large and that net national income can be raised by the second alternative.

W040.0020 Henderson, P.D., "Notes on Public Investment Criteria in the U.K.," *Bulletin of the Oxford Institute of Economics and Statistics,* Vol. XXVII, No. 1 (February 1965), 55-89.

W040.0031 Kaser, M.C. *Planning for Children in the Context of Social and Economic Programmes.* Report to the UNICEF Round Table Conference on Planning for the Needs of Children in Developing Countries, April, 1964, Bellagio, Italy. New York, United Nations International Children's Emergency Fund, 4 March 1964.

The report considers the administrative coverage of a development programme with special reference to the 'child-welfare sector', viz. education, public health, nutrition, employment orientation and placement, and social legislation, in the preparation of a national development plan, lists the elements in the resource survey and plan objectives and describes the confrontation of costs and benefits. It concludes with a review of the institutions required for implementation. Reference is chiefly made to the Indian Third Five-Year Plan and to the Mehrauli Project.

W040.0040 Organization for Economic Cooperation and Development. *Regional Rural Development Programmes with Special Emphasis on Depressed Agricultural Areas Including Mountain Regions.* Paris, OECD, August 1964.

Topics in this report included the following: objectives in rural areas development programmes (formulation and choice); definition and identification of critical zones; development and execution of action programmes; the contribution of industry, tourism and allied services; motivation, training, retraining and mobility of rural manpower; coordination between the various Ministries and Services; and the role of the Central Administration.

W040.0060 Peacock, A.T. and Wiseman, J. *The Growth of Public Expenditures in the United Kingdom.* National Bureau of Economic Research. Princeton, N.J., Princeton University Press, 1961.

While there are few specific references to education in this volume, it is nevertheless a useful source of explanatory hypotheses about the changing trends in public expenditures on social services. It is the authors' thesis that decisions about public expenditures are essentially political in nature (see ch. 2 on 'Determinants of Government Expenditure'). Ch. 6 on 'Central and Local Government Expenditures' throws light on controversies about educational finance in Britain. (M. Blaug)

W040.0080 Reid, G.L. and Robertson, D.J., eds. *Fringe Benefits, Labour Costs and Social Security.* London, G. Allen and Unwin Ltd., 1965.

An attempt to measure the economic importance of fringe benefits for employees in Britain as compared with the United States and Europe. Includes results from a survey in Glasgow on expenditures on fringe benefits for manual workers, including sick pay, redundancy schemes, holidays with pay, pension schemes, and free education. This section provides an analysis of each type of benefit by industry, size of firm, etc. The question whether free education is a fringe benefit for the employee or an investment for the firm is briefly discussed. (M. Blaug)

HEALTH

Expenditures — General

W100.0001 Acuna, G. *Ejecucion y Control de Presupuesto por Programas Medicion de Resultados.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

W100.0004 Alexander, Joe. *An Evaluation of New Positions Appropriated for the Hawaii State Hospital by the Third Legislature of the State of Hawaii.* Mental Health Division, Department of Health, Hawaii State Hospital, 1964.

W100.0008 Bennett, Charles G. and Bruyere, Paul T., "Design and Procedures in the Hawaii Health Surveillance Program," Proceedings of the American Statistical Association Meeting of 1965, Social Statistics Section, p. 214-215.

W100.0009 Bennett, Charles G. "Findings and Planning Implications from the Hawaii Health Survey," *Hawaii Medical Journal,* Vol. 22, No. 2 (November-December 1962), 92-106.

W100.0011 Bruyere, Paul T., Scott, Alice, and Bennett, Charles G. "The Oahu Health Surveillance Program," *Hawaii Medical Journal,* Vol. 24, No. 6 (July-August 1965), 436-441.

W100.0013 Hawaii. Department of Health, Research, Planning and Statistics Office. *The Health Surveillance Program, April-September 1964.* Report No. 1, February 1965.

W100.0014 Hawaii. Department of Social Services, Administrative Services Office. *Medical Care Expenditures, State of Hawaii 1961-62.*

W100.0015 Hawaii. Department of Health, Medical Health Services Division, Hospitals and Medical Facilities Branch. *Construction Plan for Hospitals and Medical Facilities.* Prepared and published annually by the Department.

W100.0020 "Putting a Dollar Sign on Life," *Business Week,* January 21, 1967, p. 86.

This article describes a HEW cost-benefit scheme for distributing health program money according to the expected lifetime earnings of the people to be benefited. The results of the study here reported show clearly the military origins of its method and serve as a warning to those disposed to apply cost-benefit analysis recklessly.

W100.0040 Frankel, Marvin, "Federal Health Expenditures in a Program Budget," *Program Budgeting, Program Analysis and the Federal Budget,* ed. by David Novick, Cambridge, Harvard University Press, 1965, p. 208-247.

The author outlines methods of program budgeting for health that will force to the surface answers on how much improved health is worth.

W100.0060 Frankel, M. *Federal Health Expenditures in a Program Budget.* RM-4612-RC. The RAND Corp., Santa Monica, Calif., June 1965.

This memorandum presents an application of program budgeting to federal health outlays, considers existing methods of reporting on these outlays, and suggests a program format in terms of which they might be summarized. The format is applied to estimated 1965 expenditure data, and the results are used to illustrate the potential uses of a program budget in allocating resources in the health field.

W100.0080 Holtman, A.G. "Estimating the Demand for Public Health Services and the Alcoholism Case," *Public Finance,* XIX, (1964), 351-358.

W100.0100 Jahn, Julius A. "The Statistical Design and Analysis of an Experiment to Measure the Effectiveness and Costs of a Health and Welfare Program," *American Statistical Association, Proceedings of the Social Statistics Section,* Washington, (1965), 42-50.

W100.0120 Klarman, H.E. *The Economics of Health.* New York, Columbia University Press, 1965.

Undoubtedly the best introduction to the field of health economics. Certain sections of the book, such as 'Distinctive Economic Characteristics,' 'The Case for Intervention,' 'Costs and Benefits of Health Programs,' 'What Can We Afford to Spend,' and the entire chapter on 'Supply of Personnel,' pp. 10-20, 47-56, 74-102, 162-177, are directly related to issues in educational economics. The book includes an unusually comprehensive bibliography. (M. Blaug)

W100.0140 Marshall, A.W. *Cost/Benefit Analysis in Health.* P-3274. The RAND Corporation, Santa Monica, Calif., December 1965. (DDC No. AD 624-778).

Discussion of the economics of medical care and medical research. The author reviews the relevant research on the problem of cost benefit analysis in health (the focus is on the work of economists interested in the economic implications of improved health), and explores the likely requirements, difficulties, and opportunities for cost-effectiveness studies in government health programs. A sample program budget for health prepared by the Bureau of the Budget is included.

W100.0160 Maryland State Department of Health and Mental Hygiene. *Maryland State Comprehensive Plan for Community Health Service.* Baltimore, Maryland. State Department of Health and Mental Hygiene, 1965.

W100.0180 Maryland Tuberculosis Association. *Report of a Three-Year Demonstration Health Community Projects Program Conducted in the Mount Royal-Fremont Area, 1962-1965.* Baltimore, Maryland, August 1965. Prepared by Naomi H. Evans, Director, Special Projects.

Conclusions: (1) The impact of social conditions and rapid social changes have produced a disturbing number of health and welfare problems in the inner city. (2) A single health organization cannot attack all of the problems nor accept all the opportunities which society presents. (3) Progress in the health field resulting in a significant alteration in the way health services are provided in a community has elicited new problems for citizens. (Hospitals are highly complex, scientific institutions. Many physicians have moved from general practice to specialization, etc.) (4) The voluntary involvement of people in the life of their communities and in the solution of their collective problems can be only achieved if the problems have meaning to the citizens; if key lay leaders are involved, and their expressions and actions are accepted. (5) Professional help is needed by communities to assist citizens in understanding the characteristics of their needs and problems; to comprehend legal requirements and limitations; to enable the community to arrive at a satisfactory solution to their problems. Moreover, this professional help is needed to communicate knowledge about a neighborhood, its level of acceptance and understanding, etc., to health agencies in order that agencies can plan programs and make policy determinations based upon community need. (6) Citizen participation in health planning is needed in order to meet the demands of society.

Recognition must be given to the changes in leadership and the changes in power-structure. (Author)

W100.0200 Mushkin, S.J. "Health as an Investment," *Journal of Political Economy,* Supplement, (October 1962), 129-157.

Because health spending raises similar issues to educational spending, this survey of recent American work in the field of the economics of health is included here: it is full of suggestions and implications for the economics of education. (M. Blaug)

W100.0220 Mushkin, Selma J. and Collings, Francis d'A. *Economic Costs of Disease and Injury.* Washington, D.C. Public Health Reports, Public Health Service, U.S. Department of Health, Education, and Welfare. September 1959.

To summarize, the economic costs of disease and injury are of three types: (a) costs which use a share of the Nation's resources of manpower and materials to supply health services and their commodity components; (b) costs represented by the transfer of income and resources from the well to the sick in public and private efforts to mitigate the burdens of illness; (c) costs reflected in a reduced national production of all goods and services. These three types of costs are termed resource-use, resource-transfer, and resource-loss.

The price of control of a disease is the health resources used up in the treatment and control of a disease. In economies characterized by severely limited resources and low food supplies, there must be added the minimum essential consumption of people whose lives are saved by the successful disease control action. The economic cost of a disease for price-cost comparisons is the loss in labor product, or the amount by which the national output in a year is reduced by death, disability, and debility.

The omissions and limitations of this type of economic arithmetic are many. The scheme fails to take into account the pervasive force for social and economic change released by improvement in mortality rates and changes in expectations of survival. Changes in life expectancy and in health status radically alter attitudes toward work and enterprise. Disease and early death are deeply implanted in the mores of many people of the world. The fears, superstitions, rigid social patterns, and resistance to change are in part cultural adjustments to high disease and death rates. While they are not to be changed overnight, one cause of them will be removed when illness is limited and death rates sharply reduced.

Changes in expectation of life, moreover, alter individual attitudes toward sacrifice of some part of today's consumption for tomorrow's. The time perspective of planning and investment for economic development is deeply affected by health levels. A prospect of longer life disposes the individual to support long-run development projects because he sees for himself a better change of reaping some of their benefits. Changes in life expectancy, especially of infants and children, offer some promise of adjustment, over a period of time, in size of family, fertility rates, and age structure of the population. (Author)

W100.0240 Mushkin, S.J. and Weisbrod, B.A. "Investment in Health: Lifetime Health Expenditure on the 1960 Work Force," *Kyklos,* Vol. XVI, No. 4 (1963), 583-599.

Studies the stock of health capital in the U.S. labor force by treating health expenditures made for or by members of the labor force throughout their lifetime as investment in health: the figure for 1960 is $204 b. which is 38% of the estimated $535 b. of educational capital in the 1957 labor force. (M. Blaug)

W100.0260 Rice, Dorothy P. *Estimating the Cost of Illness.* Health Economics Series No. 6. Washington, D.C., United States Public Health Service, n.d.

This study presents a framework for calculating the economic costs of illness, disability and death and performs the calculations. Part I discusses the problems involved in measuring annual direct costs of illness, describes the procedures adopted, and presents data for selected types of health expenditures in 1963 by diagnosis. The second part deals with the annual indirect losses associated with illness, disability and death. Included are the economic concepts, estimating procedures and estimates of the total man-years lost and productivity losses resulting from morbidity and mortality in 1963 for each diagnostic category. The third part presents the methodology and resulting estimates of the present value of the future earnings for those people who die in 1963. The major diagnostic categories used and the selected subclassifications within each major category are listed in Appendix A and the calculations of the present value of lifetime earnings for each age and sex group are presented in Appendix B. (Author)

W100.0280 Stimson, David H. "Decision-Making and Resource Allocation in a Public Health Agency." Talk presented at the TIMS meeting, Rochester, New York, October 15, 1965.

An experiment carried out at the California State Department of Public Health is described. Criteria used by the management of this agency in allocating public health funds to alternate projects in public health were found to be maximizing utility.

W100.0300 U.S. Public Health Service. *Economic Benefits from Public Health Services; Objectives, Benefits, and Examples of Measurement.* Washington, D.C., U.S. Government Printing Office, 1964.

W100.0320 University of Michigan. *The Economics of Health and Medical Care,* 1962. Ann Arbor, University of Michigan, 1964.

Contents – The role of the economist in the health services industry; Organization and financing of health services; Demand, costs, and prices of health care; Investment in health; Agenda for research; Microeconomics of health care.

W100.0340 Weisbrod, B.A. *Economics of Public Health, Measuring the Economic Impact of Diseases.* Philadelphia, University of Pennsylvania Press, 1961.

A valuable little book addressed to the layman. It develops the argument that medical care is a 'public good' and evaluates the social benefits of eliminating three specific diseases. Estimates are presented for illness-induced output losses and for treatment costs; the concept of human capital is employed to measure the value of human resources destroyed by each disease. (M. Blaug)

Expenditures – Mental Health

W110.0020 Chapin, F. Stuart. "Some Housing Factors Related to Mental Hygiene," *American Journal of Public Health,* Vol. 41, No. 7 (April 1963), 839-845.

W110.0040 Eisenberg, Leon. *An Evaluation of Psychiatric Consultation Service for a Public Agency.* Baltimore, Johns Hopkins University, 1958.

W110.0041 Hawaii. Department of Health, Medical Health Services Division, Hospitals and Medical Facilities Branch. *Community Mental Health Centers–Hawaii State Plan.* Prepared and published annually by the Department.

W110.0060 Fein, Rashi. *Economics of Mental Illness.* New York, Basic Books, Inc., 1958.

W110.0070 Gudeman, Howard E. *Hawaii State Hospital Audit: Evaluation of Mental Hospital*

Program Effectiveness: A Preliminary Proposal for Cohort Analysis. Department of Health, Mental Health Division, Hawaii State Hospital, Hawaii, Unpublished, n.d.

Expenditures – Epidemics

W120.0020 Kaser, M.C. *Observations on the Likely Economic Efficiency of the Malaria Eradication Programme.* Report for the Division of Malaria Eradication, World Health Organization, 22 December 1958.

The report was requested by the World Health Organization for the preparation of a statement to UNICEF on WHO's use of UNICEF's funds for malaria eradication. The paper avoids reliance on the 'direct welfare effect' of malaria eradication, while recognizing that the WHO believes this to be a paramount aspect of the choice, and concentrates on the 'capital effect of social investment outlays' measured as Myrdal's cumulative social and economic causation. It criticizes, with bibliographic references, the previous work (notably Sinton and Winslow) and examines the quantifiable components of choice under opportunity costs; outlay as a share of national product; and the probability of consequential product increments (effects on labour force, cultivatable land, and capital capacity). A statistical appendix relates the estimated cost of malaria eradication to net national product and factor cost for a wide range of developing countries.

W120.0040 Klarman, Herbert E., "Syphilis Control Program," *Measuring Benefits of Government Investments,* Dorfman, Robert, ed. Papers presented at a conference of experts, November 7-9, 1963, Washington, Brookings Institution, 1965, p. 367-414.

A cost-benefit analysis on syphilis control programs. Since benefits would accrue to both the unemployed and the employed, a measure is made of housewives' wages in order to calculate the expected life-time earnings gained due to the program. The standard wage paid to a domestic servant is taken as the housewife's wage.

Expenditures – Foreign

W130.0020 Fein, R. "Health Programs and Economic Development," *The Economics of Health and Medical Care.* Proceedings of the Conference on the Economics of Health and Medical Care, 1962. Ann Arbor, Michigan, University of Michigan, 1964, p. 271-282.

This essay discusses the economic advisability of public health programs in underdeveloped countries, touching on the relationship between health and educational programs. See also the comment by R. Goode, *ibid.*, pp. 282-286. (M. Blaug)

W130.0040 Feldstein, Martin S. "Economic Analysis, Operational Research, and the National Health Service," *Oxford Economic Papers,* Vol. 15, (March, 1963), 19-31.

Reviews some applications of economic analysis to public expenditures, discusses the concern over efficiency in the National Health Service, and considers the value of operations research for the NHS.

W130.0060 Jewkes, S. and J. *Value for Money in Medicine.* Oxford, Basil Blackwell, 1963.

The pamphlet casts doubt on the proposition that increased expenditures on British health services would be a sound economic investment from a social point of view, demonstrating once again the difficulties of measuring the net economic gain of the social services. (M. Blaug)

W130.0080 Kaser, M.C., "Health Economics and the Classification and Articulation of Activities and Expenditures in Standardized National Accounts," Annex III to *Report of the Ad Hoc Inter-Agency Working Party on the Cost and Sources of Finance of Health Services,* Geneva, World Health Organization, June 1965.

The study recommends changes in the United Nations System of National Accounts which would improve their use for the analysis of the health sector. Revisions are grouped in four heads – consistency with administrative (originating) accounts, sector definitions (including suggestions for links with Soviet-type accounts, viz. the 'Material Product System'), the treatment of capital, and the disaggregation of tables.

W130.0100 Kaser, M.C. *Health Planning as Part of the National Development Plan.* Working Paper for the World Health Organization Expert Committee on Public Health Administration, Geneva, August 1960.

Writing as observer of the Economic Commission for Europe to the Fourth Expert Committee on Public Health Administration, the author seeks "to assure that the Health sector keeps in line with contemporary refinements of economic planning" both to "justify its essential place among claimants for resources and contributors to welfare" and "to assist health administrators themselves to allot men and materials to their most effective use." It describes recent trends in economic and social development planning, discusses the consumption and investment effects of the health programme and describes the measures appropriate to health planning.

W130.0120 Lees, D.S. *Health Through Choice. An Economic Study of the British Health Service.* London, Institute for Economic Affairs, 1961.

This attack on the collective provision and public finance of medical care in Great Britain suggests analogies to the state provision and finance of education, some of which the author himself explores. See also *Monopoly or Choice in Health Services: A Symposium of Contrasting Approaches.* London, Institute for Economic Affairs, 1964. (M. Blaug)

W130.0140 Wiseman, J. "Cost-Benefit Analysis and Health Service Policy," *Scottish Journal of Political Economy,* 1963, reprinted in *Public Expenditure. Appraisal and Control,* eds. A.T. Peacock and D.J. Robertson. Edinburgh, Oliver & Boyd, 1963, p. 128-145.

This article briefly describes available studies of investment in health and goes on to raise some serious doubts about the policy implications that are usually drawn from this type of cost-benefit analysis. With minor adjustment, these doubts are equally relevant for the rate-of-return approach to the economic value of education. (M. Blaug)

W130.0160 World Health Organization. *Health Education: A Selected Bibliography.* Educational Studies & Documents, No. 19. Paris, United Nations Educational Scientific and Cultural Organization, 1956.

Although most of this annotated bibliography deals with descriptions of existing health education programmes, other writings in health economics are also included.

URBAN RENEWAL

General

W200.0020 Baltimore Urban Renewal and Housing Agency. *Area Units for Community Renewal Program Analysis.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1964.

W200.0040 Baltimore Urban Renewal and Housing Agency. *Criteria for Community Renewal.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1965.

W200.0060 Baltimore Urban Renewal and Housing Agency. *Dollars and Sense of Urban Renewal Findings.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1966.

W200.0080 Baltimore Urban Renewal and Housing Agency. *Program Planning.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1962.

W200.0100 Baltimore Urban Renewal and Housing Agency. *Treatment Criteria for Community Renewal.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1965.

W200.0120 Bloom, Max R. "Fiscal Productivity and the Pure Theory of Urban Renewal," *Land Economics,* Vol. 38 (May 1962), 134-144.

Discusses the criteria used to evaluate the impact of land use changes resulting from urban redevelopment, pointing out the shortcomings of the fiscal productivity approach and a need for a more inclusive conceptual framework in formulating criteria for project selection.

W200.0140 Davis, Otto A. "A Pure Theory of Urban Renewal," *Land Economics,* Vol. 36, (May 1960), 220-226.

Uses profitability to evaluate urban renewal projects.

W200.0160 Davis, Otto A. and Whinston, Andrew B. "Economic Problems in Urban Renewal," *Law and Contemporary Problems,* Vol. 26 (Winter 1961), 105-117.

W200.0180 Kelnhofer, Guy J. "Slum Clearance – Its Costs and Benefits," *Tennessee Planner,* Vol. 15 (April 1955), 153-158.

Discusses the distortion of cost-benefit analyses of slum clearance projects resulting from the inadequate statistical measures of the comparative consumption of municipal services among various sections of a city.

W200.0200 Lichfield, Nathaniel. "Cost-Benefit Analysis in City Planning," *American Institute of Planners Journal,* Vol. 26 (November 1960), 273-279.

Economics can make its contribution throughout the planning process, from a survey of the economic base of the community to the economic feasibility of a particular redevelopment project. This paper is concerned with one limited aspect; how a particular tool of economic analysis, cost-benefit analysis, which in planning circles has come to be popularly called the 'Planning Balance Sheet,' should and could be used in one particular kind of plan evaluation. (Author)

W200.0220 Lichfield, Nathaniel. "Cost-Benefit Analysis in Plan Evaluation," *Town Planning Review,* Vol. 35 (July 1964), 159-69.

W200.0240 Lichfield, Nathaniel. *Cost-Benefit Analysis in Urban Redevelopment.* Real Estate Research Program, No. 20. Berkeley, California, University of California, 1962.

Discusses the techniques of cost-benefit analysis and then applies them to three case studies of urban redevelopment in San Francisco.

W200.0260 Mao, James C.T. "Efficiency in Public Urban Renewal Expenditures through Benefit-Cost Analysis," *American Institute of Planners Journal,* Vol. 32 (March 1966), 95-107.

W200.0280 Mao, James C.T. *Efficiency in Public Urban Renewal Expenditure through Capital Budgeting.* Research report 27. Berkeley, California. University of California, Institute of Urban and Regional Development, Center for Real Estate and Urban Economics, 1965.

Suggests using capital budgeting techniques to measure costs and benefits of public expenditures for urban renewal.

W200.0300 Nourse, Hugh O. "The Economics of Urban Renewal," *Land Economics,* Vol. 42 (February 1966) 65-74.

Demonstrates that current slum clearance and neighborhood rehabilitation policies do not usually produce increased property values.

W200.0320 Page, David A. "Urban Renewal," Paper presented to the Bureau of the Budget, Summer Seminar on Systems Analysis and Program Evaluation, August 10, 1965.

Discusses the objectives of the urban renewal program, analyzes two projects in the light of these objectives, and discusses the application of the cost-benefit technique to urban renewal.

W200.0340 Rothenberg, J. *Economic Evaluation of Urban Renewal: Concepted Formulation of Benefit Cost Analysis.* Englewood Cliffs, N.J., Prentice-Hall, 1961.

W200.0360 Rothenberg, Jerome, "Urban Renewal Programs," *Measuring Benefits of Government Investments,* ed. Robert Dorfman. Washington, D.C., Brookings Institution, 1965, p. 292-366.

This paper discusses the economics of land under urban renewal and probes the market influences on the effects of land development. If the largest benefit to be obtained from a given piece of land is in fact represented by slum housing, then many of the 'benefits' of urban renewal become actual 'costs' and must be so accounted for if benefits are not to be overestimated. The benefits that would then accrue would be social rather than economic and might, therefore, be overlooked. Some considerations can be listed as costs or benefits, depending on one's philosophy: government vs. private development, slums spreading into neighboring non-slum areas (some of which might be optimally utilized as slums for the first time), interference with the costs and benefits of other projects, etc. Cost-benefit analysis is shown to be very susceptible to uncertainties and oversimplification in the area of urban renewal, e.g., it may at great cost interfere with reforms that would at small cost accomplish the same objective (best possible use of land). This might be the case, for example, if a reform in tax laws would encourage neighborhood landlords to reverse the trend towards slums.

W200.0380 Schaff, A.H. "Public Policies in Urban Renewal: An Economic Analysis of Justifications and Effects," *Land Economics,* Vol. 40 (February 1964), 67-78.

W200.0400 Schaller, Howard G., (ed.). *Public Expenditure Decisions in the Urban Community.* Papers presented at the Conference on Public Expenditure Decisions in the Urban Community, Washington, May 14-15, 1962, under the sponsorship of the Committee on Urban Economics of Resources for the Future, Inc., Johns Hopkins Press, Baltimore, 1963.

Benefit-cost analysis as a tool in urban government decision-making, by Nathaniel Lichfield and Julius Margolis, pp. 11-146; Costs and benefits from different viewpoints, by Roland N. McKean, pp. 147-162.

W200.0420 Stone, P.A. "The Economics of Housing and Urban Development," *Royal Statistical Society Journal,* Series A, Vol. 122, Part 4 (1959), 417-483.

Discusses techniques for deriving comparative costs of different types of development to determine the impact of the development on the national economy and the total real cost to the community.

W200.0440 Thompson, Wilbur R. *A Preface to Urban Economics.* Published for Resources for the Future, Inc., Johns Hopkins Press, Baltimore, 1965.

Housing

W210.0020 Burns, Leland, S., "Cost-Benefit Analysis of Improved Housing: A Case Study," *Cost-Benefit Analysis of Social Projects.* Geneva, United Nations Research Institute for Social Development, April, 1966.

A new housing development was built on an Indian reservation where there were no other welfare programs. This controlled situation produced decreased absenteeism and better health. A cost-benefit study was made.

W210.0040 Burns, Leland S. *Report on a Pilot Study of Worker Productivity in Relation to Housing Conditions.* International Housing Productivity Study, Real Estate Research Program, Graduate School of Business Administration, University of California, Los Angeles, 1965.

W210.0060 Hole, Vere. "Social Effects of Planned Rehousing," *Town Planning Review,* Vol. 30, No. 2 (July 1959), 161-173.

W210.0069 Housing Authority of Baltimore City. *The Broadway-Fells Plan.* Baltimore, Maryland, Housing Authority of Baltimore City, 1950.

W210.0071 Kaplan, Marshall, Gans, and Kahn for the Authority. *Feasibility Study-Application for a Leased Housing Program.* Department of Social Services, Hawaii Housing Authority, Unpublished.

W210.0080 Kuminck, Edward, "Analysis of the Economic Effects of Housing Investment," *Cost-Benefit Analysis of Social Projects.* Geneva, United Nations Research Institute for Social Development, April, 1966.

The Polish method of cost-benefit analysis for housing projects is described. Intangible benefits are replaced by tangible benefits which are thought to lead to the intangibles. In this way the benefits are thought to be more concretely measured. As an example: amount of each apartment's exposure to sunshine is measured.

W210.0100 Morton Hoffman and Company. *Assessment of Projected Housing Resources and the Housing Market.* Baltimore, Maryland, Morton Hoffman and Company, 1955.

W210.0200 Morton Hoffman and Company. *Assessment of Present Housing Resources and the Housing Market.* Baltimore, Maryland, Morton Hoffman and Company, 1965.

Project Reports

W220.0020 Baltimore Urban Renewal and Housing Agency. *Charles Center Urban Renewal Plan.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1961.

W220.0040 Baltimore Urban Renewal and Housing Agency. *Community Renewal Program.* Baltimore City Department of Planning, 1966.

This study discusses the costs and benefits of an urban renewal plan for the city of Baltimore. It is well-documented and clearly presented. Over-all and interim plans are discussed, as are previous attempts to fight blight in the city.

W220.0060 Baltimore Urban Renewal and Housing Agency. *General Neighborhood Renewal Plan for the Mt. Royal Fremont Urban Renewal Area.* Baltimore, Md., Baltimore Urban Renewal and Housing Agency, 1960.

W220.0080 Baltimore Urban Renewal and Housing Agency. *Mount Vernon Urban Renewal Plan.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1963.

W220.0100 Baltimore Urban Renewal and Housing Agency. *Project I: Mount Royal Fremont Urban Renewal Area.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1962.

W220.0120 Baltimore Urban Renewal and Housing Agency. *Project I-A: Mount Royal Fremont Urban Renewal Area.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1962.

W220.0140 Baltimore, City Planning Commission. *Redevelopment of Blighted Residential Areas in Baltimore.* Baltimore, Maryland, City Planning Commission, 1945.

W220.0160 Baltimore Urban Renewal and Housing Agency. *Review of Previous Criteria Used to Measure the Nature, Degree, and Extent of Blight in Baltimore City.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1964.

W220.0180 Baltimore Urban Renewal and Housing Agency. *Ten Years of Relocation Experience in Baltimore, Maryland.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, 1961.

W220.0200 Greater Baltimore Committee, Inc. *Baltimore's Stake in Urban Renewal.* Baltimore, Maryland, Greater Baltimore Committee, Inc., 1956.

W220.0220 Moore, Donald E. *An Evaluation of the Harlem Park Neighborhood Rehabilitation Project.* New York, The Action Council for Better Cities, 1965.

W220.0240 Planning Council, Greater Baltimore Committee, Inc. *Mount Vernon Urban Renewal Plan.* Baltimore, Maryland, Greater Baltimore Committee, Inc., 1960.

TRANSPORTATION

Theory

T010.0020 Cherniack, N. *Effects of Travel Impedance Cost.* Highway Research Board of the National Academy of Sciences, National Research Council. Special Report 56. Washington, D.C., National Academy of Sciences – National Research Council 1960.

T010.0040 Crumlish, Joseph D. *Notes on the State-of-the-Art of Benefit-Cost Analysis as Related to Transportation Systems.* NBS Technical Note No. 294. Washington, D.C., United States Department of Commerce, National Bureau of Standards, November, 1966.

This review of benefit-cost analysis as a tool for evaluating alternative courses of action describes the technique, discusses a number of benefit-cost studies, and indicates the difficulties inherent in this area of applied economics. The author concentrates on the application of the technique to large scale transport problems, reviews the literature and indicates in his conclusions where the technique can be helpful and where there is little chance for its success.

An accompanying matrix of benefit-cost studies and a commentary thereon is supplied by Marsha Geier, an NBS economist. Miss Geier's literature search failed to produce any analytic methods which were comprehensive, theoretically justifiable, operational or significant. This finding tended to support the views of the author. (Introduction by Alan J. Goldman, Applied Mathematics Division, Institute for Basic Standards, National Bureau of Standards.) (Author)

T010.0060 Foster, C.D. *The Transport Problem.* London, Blackie and Son, 1963.

The social surplus criterion, p. 62-68; The consumers' surplus criterion for railways, p. 117-150; The consumers' surplus criterion for investment in roads, p. 254-279; Coordination of investment, p. 298-300; Summary of conclusions, p. 307-309; Opportunity cost and time preference rates, p. 321-322.

T010.0080 Fromm, Gary. "Introduction: An Approach to Investment Decisions," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 1-17.

T010.0100 Grant, E.L. *Interest and the Rate of Return on Investment.* Highway Research Board of the National Academy of Sciences, National Research Council, Washington, D.C. Special Report 56, 1959, p. 82-90.

T010.0120 Heflebower, Richard B. "Characteristics of Transport Modes," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 34-68.

T010.0140 Haikalis, George, and Joseph, Hyman. "Economic Evaluation of Traffic Networks," *Studies in Highway Engineering Economy.* Highway Research Board of the National Academy of Sciences, National Research Council. Bulletin 306. Washington, D.C., 1961, p. 39-63.

Economic analysis of a traffic network requires estimation of the total travel costs to the users and the total capital requirements to provide the system. The paper describes a method for determining these costs of a network by use of electronic data processing machines.

The three components of travel costs (operating, accident and time costs) are related to average daily speed on each link in the network. Speeds are based on type of route, capacities, daily traffic flow (as given by a traffic assignment), and relative location.

Examples of Chicago area data and results are given. Selection of the least cost plan of several alternatives is made. (Author)

T010.0160 Kuhn, Tillo E. *Public Enterprise Economics and Transport Problems.* Berkeley, Calif.,

University of California Press, 1962.

Discusses the problems of evaluating public enterprise actions, proceeding from definitions to analysis, from the detailed to the general, from the individual project to processes in the economy at large.

T010.0180 Nelson, James R. "Pricing Transport Services," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 195-223.

'Price transport services at the marginal cost of providing them' is the classic recipe of economists who employ the approach of comparative statics. Since decreasing costs are involved in practically every form of transport–at least in the provision of infrastructure–the recipe would necessarily produce receipts inadequate to cover costs. Of all the classical writers on marginal cost pricing, Dupuit is the greatest name. And Dupuit combined a belief in *marginal* cost pricing with a belief in levying extra charges to cover *total* costs as well.

Due to the governmental character of highway development and the combination of access and movement utilities which highways provide, developing countries may face technical problems of collecting for value of service rendered. Special assessments or other localized fees and taxes should be used to recover access values. Straight-line taxes and fees (as a first approximation, a gasoline tax) are adequate for the portion of highway costs which changes in exact ratio to volume of transport. Special charges against transport entering or leaving the largest cities may be required to recover any residual highway costs, on the rationale that a metropolis typically receives and dispatches shipments for longer average distances and obtains more net benefits, per capita or per ton, from the existence of an integrated transport network. (Author)

T010.0200 U.S. National Bureau of Standards. *Notes on the State-of-the-Art of Benefit-Cost Analysis as Related to Transportation Systems.* Washington, D.C., November 1, 1966.

T010.0220 Universities-National Bureau Committee for Economic Research. *Transportation Economics, A Conference Sponsored by the Committee.* New York, Columbia University Press, 1965.

The uses and measurement of costs for transport policy, p. 1-165; Urban transportation, p. 245-348.

T010.0240 Vickrey, William. "Pricing and Resource Allocation in Transportation and Public Utilities; Pricing in Urban and Suburban Transport," *American Economic Journal,* (May 1963) 452-465.

Discusses marginal cost pricing for optimal use of transportation facilities.

Planning

T020.0020 Adler, Hans A. "Economic Evaluation of Transport Projects," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 170-194.

T020.0030 Beesley, M.E. "The Value of Time Spent in Travelling: Some New Evidence," *Economics,* Vol. XXXII, No. 126, May 1965.

T020.0040 Fromm, Gary. "Design of the Transport Sector," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 89-107.

The investment decisions made today affect not only the standard of living of the present generation, but those of the future as well. Because the need to raise the rate of growth and the income per capita in the less developed nations is great, and because the economic returns and social consequences of a purely laissez-faire approach can be so significantly enhanced, government intervention to improve the allocation and utilization of resources is advantageous. Such intervention need not and probably should not, take the form of direct control over all directly productive activities. But there is a clear necessity for establishing guidelines and policies under which the private sphere will operate more efficiently, and for providing basic facilities, including transportation, that are needed. The most effective way of doing this is by means of an intensive comprehensive planning effort. Whatever the limitations of this method, its solutions are superior to those resulting when decisions are merely optimized for each sector independently and feedback and interdependent long-range effects are largely ignored. Economy-wide planning should not be implicit, but explicit. Nevertheless, for some countries, this technique cannot become fully operational in the near future because of gaps in requisite data and shortages of trained personnel. (Author)

T020.0060 Fromm, Gary. (ed.). *Transport Investment and Economic Development.* Washington, D.C., The Brookings Institution, Transport Research Program, 1965.

Contents: "Introduction: An Approach to Investment Decisions" by Gary Fromm; "The Objectives of Transportation" by Hans Heymann, Jr.; "Characteristics of Transport Modes" by Richard B. Heflebower; "Transport and Technology" by Wilfred Owen; "Design of the Transport Sector" by Gary Fromm; "Economic Development and Regional Growth" by Louis Lefeber; "Transportation in Soviet Development" by Holland Hunter; "Regional Development Policy" by Mitchell Harwitz; "Economic Evaluation of Transport Projects" by Hans A. Adler; "Pricing Transport Services" by James R. Nelson; "Financing Transport Investment" by A. Robert Sadove and Gary Fromm; and "The 'Railroad Decision' in Chile" by Robert T. Brown.

T020.0080 Harwitz, Mitchell, Regional Development Policy," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 144-169.

T020.0100 Heymann, Hans, Jr. "The Objectives of Transportation," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 18-33.

Transportation in any society serves a variety of conflicting and incommensurable ojectives. The selection of a national transportation system implies a choice among these goals. Such a choice cannot be approached as a straightforward economic efficiency problem; it constitutes a high-level policy decision. The economist can best contribute to this policy decision by offering up his transportation plans as a range of feasible transportation alternatives together with a prognosis of some of their foresee-

able social implications. In this way he may help the community to broaden its own perception of its goals and values. On the other hand, the past performance of economists and planners in this sphere, both in the market-oriented West and in the centrally planned East, has been less than inspired. Finally, the validity of a widely held faith that transportation stimulates new productive activity is questioned. Where a nation is deficient in the factors conducive to growth, no amount of transport investment will create the economic dynamism that is so ardently desired. (Author)

T020.120 Meyer, J.R. *Transportation in the Program Budget.* RM-4452-RC. The RAND Corporation, Santa Monica, California, February 1965.

A discussion of the possible use of program budgeting in evaluating the transportation development programs of the Federal Government. The author suggests that expenditures for such programs, which now total eight billion dollars annually, could be organized under five headings that reflect the various intentions of the programs. The memorandum explores the relationships among these programs and other policy objectives of the Federal Government to measure the consistency of the programs with each other and with broader objectives of public policy. In conclusion, different possible reorganizations within the transportation sector are discussed in terms of how they might best serve program budgeting objectives.

T020.0140 Owen, Wilfred. "Transport and Technology," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 69-88.

Modern technology has greatly improved the possibility that the obstacles to development imposed by poor transport can be overcome. In some cases the solution will be in doing conventional things better, and in others the answer will lie in approaching old problems in entirely new ways. There are thus two basic problems to be overcome. One is to take better advantage of what is already possible, and the second is to undertake the research and development necessary to accelerate further innovation.

If the first problem is to be overcome, it will be necessary to provide the basis for selecting among alternative technologies, as well as the organizational and policy frameworks in which wise choices can be made. The principle drawbacks now are partly the absence of sufficient information on cost and performance records in developing countries. But a further obstacle to decision making is that each segment of the transport system is separately provided and programmed. The result is that transport alternatives may never enter into consideration when investments are being planned. Finally, the larger view of the relation between transport and development goals too often conceals alternative approaches to solution that may not involve transport at all.

The situation calls for overhauling transport administration and planning procedures to permit a total transport approach in the context of the economic development effort as a whole. At the same time there is urgent need for an imaginative program of research and development that will focus on new transport techniques and new techniques for meeting transport requirements in more effective ways through scientific innovations outside the transport field. (Author)

T020.0151 *Rentability Prospects Regarding the Coen and IJ Tunnel Projects.* Rentabiliteits–Verwachtingen van de Coen – en IJ-Tunnelprojectn, The Netherlands, The National Budget, Chapter IXB, No. 9, 1961.

T020.0154 Ronningen, J. *Transportation Planning Objectives–A Bibliography.* Department of Planning and Economic Development, Transportation, Hawaii, June 22, 1965.

T020.0160 Sadove, A. Robert and Fromm, Gary. "Financing Transport Investment," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 224-241.

The chief lesson of this essay is that the conclusions of economic and financial analyses can conflict. Conclusions based solely on either economic rates of return or financial analysis should not determine investment priorities. A combined approach should be utilized. In project appraisal the basic data being used in the calculation of returns frequently are subject to unusual error or regulatory distortion. Experience in a number of cases indicates that these calculations may not only be based on faulty data or subject to wide margins of error, but they may not always encompass the largest developmental effects associated with a project. Furthermore, there is rarely complete agreement in any particular case regarding either the opportunity rates of return throughout the economy or the minimum rate of return acceptable for the particular project being appraised. The rates for different sectors may not be identical because resources, including capital, are not equally available to, or fully transferable between sectors. That is, different resource constraints may cause different opportunity rates of return. In practice, the rate usually has to be chosen under the stress of operational time pressures and often with insufficient knowledge of the returns from alternative investments. (Author)

T020.0180 Shine, Maurice J. *An Investigation into the Control of Vehicle Maintenance and Operating Costs at Selected Activities.* Master's thesis, Naval Postgraduate School, Monterey, California, 1964. (DDC No. AD 482-369).

This study discusses the various connotations of the concept of control. Technical control as exercised by the comptroller of the Navy and the chief, Bureau of Yards and Docks, is traced as it relates to the transportation function in the Navy. Following a brief description of the industrial fund, the techniques employed in the control of vehicle maintenance and operating costs at three activities are analyzed.

Transportation – Air

T100.0010 Airborne Instruments Lab. *Airport Capacity. A Handbook for Analyzing Airport Designs to Determine Practical Movement Rates and Aircraft Operating Costs.* Deer Park, N.Y., June 1963. (DDC No. AD 413450).

To determine the adequacy of existing or future airport designs in coping with the steady yearly increases in aircraft traffic rates, some accurate means of analyzing airports must be provided to determine capacities in terms of both the movement rates and the aircraft operating costs resulting from the rates of flow of aircraft. This handbook is the result of research into airport operation and has involved studies of aircraft characteristics and pilot/controller requirements and techniques.

Much of the data was obtained from exhaustive field surveys. It is designed to permit the user to determine: Capacity of a given airport; relationship of the capacity of a given airport to the traffic demand; and effects of

the capacity and demand on airport improvements or changes and vice versa.

T100.0020 Fort, Donald M. *Systems Analysis as an Aid in Air Transportation Planning.* P-3293. The RAND Corp., Santa Monica, Calif., January 1966. (DDC No. AD 627-384)

This paper discusses possible uses and limitations of systems analysis as an aid in air transportation planning. Following some general remarks on the subject, consideration is given to the application of systems analysis to a few arbitrarily selected non-military air transportation planning problems, to illustrate various pertinent points. The emphasis is on the important initial steps in formulating the analysis, beginning with the identification and definition of the problem. The need for realistic and relevant inputs is stressed. No attention is given to particular analytical or computational models or techniques. It is suggested that systems analysis can be anything from very useful to worse than useless in air transportation planning, depending on the quality of the analysis. (Author)

T100.0040 Fromm, Gary, "Civil Aviation Expenditures," in Dorfman, Robert, ed., *Measuring Benefits of Government Investments.* Papers presented at a conference of experts, Nov. 7-9, 1963. Washington, Brookings Institution, 1965, p. 172-230.

Dr. Fromm starts by considering an industries benefits to the society as the total of all the costs that would result from not having that industry. He shows that omitting CBA of data for building aircraft facilities results in wasted money even though CBA is confronted with difficulties and uncertainties. An attempt is made to deal with the situation in which various different groups of users benefit to different extents while costs are distributed evenly or unevenly among them. The value of the entire air travel industry is estimated.

T100.0060 Fromm, Gary. *Economic Criteria for Federal Aviation Agency Expenditures.* Prepared for Aviation Research and Development Service, Federal Aviation Agency, June 1962. Cambridge, Mass., United Research, Inc., 1962.

T100.0065 Hawaii. Department of Transportation, Airports Division. *Master Plan for the Lanai Airport.* September 1964.

T100.0080 Lanka, G. "A Report on Benefit-Cost Analysis and Performance Measurement of the Air Traffic Control System." Unpublished paper for Office of Policy Development, Federal Aviation Agency, Washington, D.C., April 1963.

T100.0100 McDonnell Aircraft Corporation. *Technical and Economic Evaluation of Aircraft for Intercity Short-Haul Transportation.* Volume I, Final report. St. Louis, Mo., April 1966. (DDC No. AD 641-506).

This report evaluates the potential airline use of STOL/VTOL aircraft to serve intercity short haul travelers. The air travel market in the California corridor (between Los Angeles and San Diego on the South and Sacramento and San Francisco on the North) was used for the study but the results would be generally applicable to other areas. Based on 1970 technology, four STOL and VTOL aircraft configurations were designed as 60-, 90-, and 120-passenger transports, and developed for lowest operating costs for a 500-mile stage length. A conventional jet transport was used as a base of reference and a conventional helicopter was included for comparison.

The special STOL/VTOL airports were located for passenger convenience and acceptable noise levels for the surrounding areas. To evaluate STOL/VTOL economic viability, STOL and VTOL airline service was simulated in the California corridor in 1975 and 1980, and then compared with the conventional jet simulation in those years. It was found that the time savings and convenience provided by either STOL or VTOL airline service would enable STOL/VTOL to capture a substantial share of the short-haul air travel market when combined in a system with conventional jets, and would induce additional air travel. This system would give a satisfactory return on investment. The report is in three volumes.

Volume I is an executive summary containing introduction, conclusions, and the summary of method and results. Volume II develops each step in the method, and lists results in greater detail. Volume III contains appendices.

T100.0120 McDonnell Aircraft Corporation. *Technical and Economic Evaluation of Aircraft for Intercity Short-Haul Transportation.* Volume II, Final report. St. Louis, Mo., April 1966. (DDC No. AD 641-507).

This report evaluates the potential airline use of STOL/VTOL aircraft to serve intercity short-haul travelers. The air travel market in the California corridor (between Los Angeles and San Diego on the South and Sacramento and San Francisco on the North) was used for the study but the results would be generally applicable to other areas. Based on 1970 technology, four STOL and VTOL aircraft configurations were designed as 60-, 90-, and 120-passenger transports, and developed for lowest operating costs for a 500-mile stage length. A conventional jet transport was used as a base of reference and a conventional helicopter was included for comparison.

The special STOL/VTOL airports were located for passenger convenience and acceptable noise levels for the surrounding areas. To evaluate STOL/VTOL economic viability, STOL and VTOL airline service was simulated in the California corridor in 1975 and 1980, and then compared with the conventional jet simulation in those years. It was found that the time savings and convenience provided by either STOL or VTOL airline service would enable STOL or VTOL to capture a substantial share of the short-haul air travel market when combined in a system with conventional jets, and would induce additional air travel. This system would give a satisfactory return on investment. The report is in three volumes.

Volume I is an executive summary containing introduction, conclusions, and the summary of method and results. Volume II develops each step in the method, and lists results in greater detail. Volume III contains appendices.

T100.0140 McDonnell Aircraft Corporation. *Technical and Economic Evaluation of Aircraft for Intercity Short-Haul Transportation.* Volume III, Final report. St. Louis, Mo., April 1966. (DDC No. AD 641-508).

This report evaluates the potential airline use of STOL/VTOL aircraft to serve intercity short-haul travelers. The air travel market in the California corridor (between Los Angeles and San Diego on the South and Sacramento and San Francisco on the North) was used for the study but the results would be generally applicable for other areas. Based on 1970 technology, four STOL and VTOL aircraft configurations were designed as 60-, 90-, and 120-passenger transports, and developed for lowest operating costs for a 500-mile stage length. A conventional helicopter was

included for comparison.

The special STOL/VTOL airports were located for passenger convenience and acceptable noise levels for the surrounding areas. To evaluate STOL/VTOL economic viability, STOL and VTOL airline service was simulated in the California corridor in 1975 and 1980, and then compared with the conventional jet simulation in those years. It was found that the time savings and convenience provided by either STOL or VTOL airline service would enable STOL or VTOL to capture a substantial share of the short-haul air travel market when combined in a system with conventional jets, and would induce additional air travel. This system would give a satisfactory return on investment. The report is in three volumes.

Volume I is an executive summary containing introduction, conclusions, and the summary of method and results. Volume II develops each step in the method and lists results in greater detail. Volume III contains appendices.

T100.0160 Reich, P.G. *An Exercise in Costing the Effect of Air Traffic Control Restrictions on North Atlantic Traffic.* Royal Aircraft Establishment, Farnborough, England, March 1963. (DDC No. AD 410-731).

The costs borne by airline operators as a result of restrictions by oceanic air traffic control are estimated for the North Atlantic for 1961, 1964, and 1967. The 1964 and 1967 estimates are based upon fixed-track systems adjusted to the daily wind forecast. The analytical techniques used necessarily aim at an average interpretation of a wide variety of factors. As they may be controversial, they are described in detail. High, low, and intermediate estimates are presented to indicate the variability of this sort of exercise. Some methods for designing a route structure for least overall cost are described.

T100.0180 Swaine, Harold R. *A Proposal for Control of Local Service Subsidies.* P-3184. The RAND Corporation, Santa Monica, California, 1965.

Evaluates various procedures for efficient use of funds in Federal subsidies for local air service. Also in *Journal of Air Law and Commerce,* Vol. 31 (Summer 1965), 181-197.

T100.0200 U.S. Federal Aviation Agency, Economics Division. *Direct Operating Costs and Other Performance Characteristics of Transport Aircraft in Airline Service for Calendar Year 1965.* Washington, D.C., September 1966. (DDC No. AD 640-678).

The report describes measures of aircraft performance and direct operating cost achieved in recent airline service. It is designed specifically to show, for the various types of airline aircraft, data on utilization, seating capacities, speeds, fuel consumption, and average stage lengths as well as on direct operating costs and the elements thereof.

Transportation – Water

T200.0100 Curran, D.C. *Evaluation of Federal Navigation Projects.* Report of Commission on Organization of Executive Branch of the Government, Task Force on Water and Power. Washington, D.C., U.S. Government Printing Office, 1955, p. 1317-1394.

T200.0200 Howe, Charles W. "Methods for Equipment Selection and Benefit Evaluation in Inland Waterway Transportation," *Water Resources Research,* Vol. 1 (First Quarter 1965), 25-39.

T200.0300 Ferguson, Allen R., *et al. The Economic Value of the United States Merchant Marine.* Evanston, Illinois Transportation Center at Northwestern University, 1961.

T200.0400 Renshaw, Edward F. "A Note on the Measurement of the Benefits from Public Investment in Navigation Projects," *American Economic Review,* Vol. 47, No. 5 (September 1957).

This paper attempts to apply elements of economic theory to the established procedure used by the Corps of Engineers to estimate navigation benefits. The author poses the question, can contemporary public investment in navigation projects be reasonably justified on the basis that expected benefits will exceed costs?

Transportation - Land - Highways

T320.0010 Amado, Antonio. *Programacion de Caja.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

T320.0040 Jones, Garred P. *Developing Future Highway Plans.* Department of Planning and Economic Development, Streets and Highways, Hawaii, April 7, 1965.

A talk delivered at the Annual Meeting of the Honolulu Automobile Club.

T320.0067 Hawaii. Department of Transportation, Highways Division, Highway Planning Branch. *A Program for Highway Beautification.* February 7, 1966.

T320.0068 Hawaii. Department of Transportation, Highways Division, Highway Planning Branch *A Study of the Feasibility of a Wailuku Bypass.* January 1964.

T320.0069 Hawaii. Department of Transportation, Highways Division, Highway Planning Branch. *The Long-Range Program of Highway Beautification, State of Hawaii.* March 1965.

Highways - Accidents

T321.0020 Billingsley, Charles M. and Jorgenson, Dayton P. "Direct Costs and Frequencies of 1958 Illinois Motor-Vehicle Accidents," *Highway Research Record,* No. 12, Publication 1109, Washington, D.C., Highway Research Board of the National Academy of Sciences-National Research Council, 1963.

"Accident experience of owners and operators of Illinois registered passenger cars and trucks during the study year 1958 is related, in terms of costs incurred and accident frequencies, to the various highway systems by passenger cars and trucks of different sizes and weights.

A portion of the paper compares accident occurence and costs in urban vs. rural areas, and discusses the impact of the large metropolitan area of Chicago with respect to the total direct cost determination for the State.

An analysis of the various cost elements (property damage, injury treatment costs, value of time lost, legal fees, etc.) that make up the total direct costs of motor vehicle accidents is included."

T321.0040 Claffey, P.J. *Motor Vehicle Operating and Accident Costs and Benefits Arising from Their Reduction Through Road Improvement.* Highway Research Board Special Report 56. Washington, D.C., National Academy of Sciences - National Research Council, 1960, p. 109-112.

T321.0060 Illinois. Department of Public Works and Buildings, Division of Highways. *Cost of Motor Vehicle Accidents to Illinois Motorists,* 1958. July, 1962.

T321.0080 Jorgenson, Dayton P. "Accident Costs and Rates on Chicago Area Streets and Highways," *CATS' Research News,* Vol. 4 (March 30, 1962), 2 - 11.

T321.0100 Jorgenson, Roy E. *Programming Highway Accident Reduction.* Highway Research Record No. 12, Publication 1109. Washington, D.C., National Academy of Sciences-National Research Council, 1963.

The highway accident analyses reported in this paper were undertaken to determine the degree to which the incidence of accidents is influenced by the level of adequacy of highways. It was accomplished in connection with the highway needs and planning studies in the States of Kansas, South Dakota and Kentucky. Answers were sought to such questions as whether a modern highway is safer than one that has deficiencies in its geometric and structural features, and if it is, how much safer.

In evaluating highway needs and in recommending improvement programs, providing safety for the highway users assumes paramount importance. The studies in Kansas, South Dakota, and Kentucky have as a basic objective the creation of a continuing long-range plan for raising the service adequacy of the roads and streets to a level that provides efficiency and safety. There are guidelines available through established and widely accepted geometric and structural standards. There are, however, no definitive measures of what application of these standards will produce in the way of added safety, except for freeways–controlled-access highways. (Author)

T321.0120 Reynolds, D.J. "The Cost of Road Accidents," *Journal of the Royal Statistical Society,* Series A, Vol. 119, No. 4, 1956.

T321.0140 Thedie, J. and Abraham, C. "Economic Aspect of Road Accidents," *Traffic,* Engineering and Control II, 1961.

T321.0160 Twombly, B.B. "The Economic Cost of Traffic Accidents in Relation to the Highway Systems," *Public Roads,* Vol. 31, No. 2 (June 1960), 33-52.

T322.0020 American Association of State Highway Officials, Committee on Planning and Design Policies. *Road User Benefit Analysis for Highway Improvements: A Report.* Washington, D.C., American Association of State Highway Officials, 1960.

T322.0040 Baldock, R.H. *The Annual Cost of Highways.* Highway Research Record No. 12, Publication 1109. Washington, D.C., National Academy of Sciences–National Research Council, 1963.

A method for determining annual cost of highways has many uses in highway economics, including a comparison of pavement types. To date, several state highway departments are not using any economic yardsticks to select pavement types, as shown in a recent Stanford Research Institute study which found that only 7 of 21 states examined used some type of formalized procedure toward this objective. Inasmuch as the American Association of State Highway Officials has not yet adopted a method for solving this important problem of comparison, this paper may serve to create further interest in this subject. (Author)

T322.0060 Beesley, M.E. and Reynolds, D.J. *The London/Birmingham Motorway: Traffic and Economics.* Road Research Laboratory Technical Paper No. 46. London, Road Research Laboratory, 1960.

T322.0080 Blensly, R. C. "Benefits to Utilities from Rural Highway Locations in Oregon," *Benefits to Utilities from Highway Locations.* Highway Research Board Special Report 75. Washington, D.C. National Academy of Sciences – National Research Council, p. 52-59.

The recent emphasis on economic impact studies and the need for determining non-user as well as user benefits from highway improvements has resulted in the Oregon State Highway Departments having the University of Oregon, Bureau of Business Research, prepare a study on electric utility benefits resulting from free use of rural highway right-of-way, the approximate benefits received, and the cost incurred from such use. Use of rural highway right-of-way by utilities benefits the utility by eliminating the necessity to acquire easements from private property owners providing easy access and inspection, and reducing maintenance costs. Disadvantages to the utility result from the necessity of paying for relocation resulting from highway changes and damages to utility equipment by vehicular accidents.

The study showed net monetary benefits to utilities, with the advantages generally outweighing the disadvantages. The existence of utility lines on the highways seriously affects the highway user when their presence (a) decreases safety, (b) increases cost of highway construction and maintenance, (c) reduces flow of traffic and (d) interferes with the aesthetics of the landscape. (Author)

T322.0100 Bos, H.C. and Koyck, L.M. "The Appraisal of Road Construction Projects," *Review of Economics and Statistics,* Vol. 43 (Feb. 1961), 13-20.

T322.0120 California Highways and Public Works. *Industry and Freeways.* Sacramento, California, May-June 1954.

T322.0140 Claffey, Paul J. "Characteristics of Passenger Car Travel on Toll Roads and Comparable Free Roads," *Studies in Highway Engineering Economy.* Highway Research Board Bulletin 306. Washington, D.C., National Academy of Sciences–National Research Council, 1961, p. 1-22.

Among the factors important to an accurate analysis of the benefits accruing to passenger car users through highway improvements are (a) average over-all rates of fuel consumption and speed by type of road, (b) the effects on passenger car operation of traffic impedances, (c) relative attractiveness of the different types of highway improvement benefits to motorists, and (d) the value to motorists of time saving and increased driving comfort. Data useful to passenger car benefit studies in connection with each of these factors were obtained in 1959 during the operation of a passenger car over 14,000 miles on primary highways in 17 states. These data included rates of fuel consumption, over-all speeds, speed changes identified by cause, and records of all traffic impedances.

The study route included, in addition to many miles where the only service was provided by free roads, 14 sections of toll route where drivers traveling between two particular points have a choice between use of a toll route or an alternate free route. At each of these comparison sections vehicle data were collected for trips on both the toll and free routes. In addition, roadside interview stations were operated on each of the alternate routes to determine the percent of local drivers choosing the toll route in preference to the free route and the reasons given by drivers for electing to use whichever route they were interviewed on. Finally, the data collected at the toll route comparison sections were subjected to a separate analysis to obtain estimates of the value to motorists of the time saving and increased driving comfort achieved through highway improvements. (Author)

T322.0160 Claffey, Paul J. "Time and Fuel Consumption for Highway User Benefit Studies," Highway Research Board Bulletin No. 276. Washington, D.C., National Academy of Sciences-National Research Council, 1960, p. 20-34.

T322.0180 Dawson, R.F.F. "A Reply to Glassborow's Criticism of the Economic Assessment of the London/Birmingham Motorway," *Bulletin of the Oxford Institute of Statistics,* Vol. 23 (Aug. 1961), 299-301.

T322.0200 Fleischer, G.A. *The Economic Utilization of Commercial Vehicle Time Saved as the Result of Highway Improvement.* Doctoral Dissertation. Stanford, California, Stanford University, Project on Engineering–Economic Planning, August 1962.

T322.0220 Fleischer, Gerald A. *Effect of Highway Improvement on Travel Time of Commercial Vehicles, A Twenty-Five Year Case Study.* Highway Research Record, No. 12, Publication 1109. Washington, D.C., National Academy of Sciences–National Research Council, 1963.

The time saved by both private and commercial vehicles as the result of expenditures for highway construction, improvement, and maintenance is clearly of considerable importance to those engaged in evaluating prospective consequences of investment decisions. Studies of actual economic analyses indicate that decisions are frequently quite sensitive to the way in which analysts treat the value of time.

In essence, there are two aspects of the 'time problem'; (a) the numerical dollar value placed on units of time savings, and (b) the method of introducing the savings in the analysis. The subject of this paper applies principally to the latter; it is essentially a case study, examining in detail the interrelationships of two major sections of highway and a principal commercial user over a 25-year period. Evidence developed clearly indicates that time is not economically significant simply when it is 'released' by highway improvement; there is a considerable lag between the point at which time is saved and that at which it can be utilized in an economic sense. If conditions represented by the study are at all representative of conditions elsewhere in the country, then it follows that present methodology is incorrect in that it fails to give proper effect to the timing of this important consequence of highway improvement. (Author)

T322.0240 Friedlaender, Ann F. *The Interstate Highway System, A Study in Public Investment.* Amsterdam, North-Holland Publishing Co., 1965.

Aims to provide a 'general framework for evaluating any large highway investment program,' and, in particular, to evaluate the costs and benefits of the Interstate Highway System.

T322.0260 Glassborow, D.W. "The Road Research Laboratory's Investment Criteria Examined," *Bulletin of the Oxford Institute of Statistics,* Vol. 22 (Nov. 1960), 327-335.

T322.0280 Goldstein, S. *Non-User Benefits from Highways.* Paper presented at 42nd Annual Meeting, Highway Research Board of the National Academy of Sciences-National Research Council, Washington, D.C., National Academy of Sciences-National Research Council, 1963.

T322.0290 Grant, E.L. and Oglesby, C.H. "A Critique of Some Recent Economic Studies Comparing Alternate Highway Locations," Highway Research Board, National Academy of Sciences-National Research Council, *Proceedings,* 39: 1-8, 1960.

T322.0300 Koplin, H.T. and Watson, D.A. *Electric Utility Non-User Benefits from Oregon Highways.* Eugene, Oregon, Bureau of Business Research, University of Oregon, March 1959.

T322.0320 Grant, Eugene L. and Oglesby, Clarkson H. "Economy Studies for Highways," *Studies in Highway Engineering Economy.* Highway Research Board Bulletin 306. National Academy of Sciences – National Research Council, Washington, D.C., 1961, p. 23-38.

Much time and effort is devoted to collecting data and preparing estimates for highway economy studies, while the actual economic analysis is accomplished quickly.

And yet if comparisons are made improperly or if certain basic assumptions are inappropriate, the decisions stemming from the analysis may be in error. The aim of this paper is to adapt certain general principles of engineering economy into the somewhat specialized circumstances of the highway framework.

Results of economy studies for highways might be stated in terms of annual cost or savings, excess of benefits over costs, benefit-cost ratio, or rate of return on investment. Properly employed and interpreted, all of these methods give correct results; improperly used, they can lead to wrong decisions. The first part of this paper illustrates, by example, the proper procedures for comparing multiple alternatives by each method and indicates some of the pitfalls to be avoided in using each of them.

Much of the raw data for economy studies for highways are based on predictions of events 20, 30, or even more years in the future. An examination of past happenings over such periods of time coupled with any consideration of today's rapid rate of change, clearly demonstrates the uncertainty of such long-range forecasts. If economy studies are made at zero interest rate, the effect is to give predictions at all future dates equal weight. As the interest rate for economy studies is increased, the effect of happenings in the more distant future is discounted. In other words, studies made at low interest rates are highly sensitive to variations in estimates of future events; studies made at higher interest rates are less sensitive to such changes. The second section of this paper examines the 'sensitivity' of economy studies to assumptions regarding estimated lives, salvage values, and expected growth or decline of benefits. Findings are presented by means of examples and graphs. (Author)

T322.0340 Great Britain. Ministry of Transport. *Report of the Panel on Road Pricing.* London, Ministry of Transport, 1964.

T322.0360 Haney, Dan G. "Use of Two Concepts of the Value of Time." *Highway Research Record, No. 12.* National Academy of Sciences – National Research Council, Washington, D.C., 1963, p. 1-18.

As the demands for highway facilities have increased with the years, it has become increasingly recognized that economic analyses of proposed highway improvement projects can provide valuable assistance in making rational decisions about the expenditure of public funds. In the very early days of highway construction, decisions were based, to a considerable extent on qualitative judgments; frequently, the only economic data available were estimates of highway construction costs. In the 1920's, economic calculations began to take into account not only the expenditures of highway agencies (such as those for construction and maintenance of improved highways) but also the expenditures of the highway traveler (such as those for fuel, oil, and vehicle maintenance). When a highway improvement would result in reductions in user costs, these user benefits could be compared with the highway agency costs to obtain an evaluation of the total transportation costs that could be associated with the improvement.

Today, as then, one of the most important user benefits of new highway construction is savings in travel time for the occupants of passenger cars. To recognize the effect of these time savings in economic calculations, it is necessary to convert the savings in hours to a dollar amount. The factor used to make this conversion is called the value of time. Thus, with the use of a value of time factor, benefit calculations include not only the out-of-pocket costs of vehicle operation, but a monetary evaluation of time savings as well.

This paper examines the meaning and the importance of the 'willingness to pay' concept of the value of time; describes a newly developed concept of the economic worth of time savings, which is called the 'cost of time'; and compares the use of the 'willingness to pay' and 'cost of time' concepts in making economic decisions on highway improvement projects. The primary intent is to demonstrate how the cost of time concept can be used to make better decisions in analyzing alternative highway designs and locations, and in formulating highway programs.

In this paper, the factors used in economic analysis have been combined into three parameters:

1. The annual highway cost, which includes the equivalent uniform annual capital of construction cost and the annual highway maintenance cost.
2. The annual user cost, which includes vehicle running costs, time costs for commercial vehicles, and accident costs.
3. The annual travel time for passenger cars.

Throughout the paper, it is assumed that the highway and user costs and the travel time have been accurately determined, and that the economic worth of savings in travel time is the variable factor of interest. The term 'value of time' is used to describe the factor for converting hours to dollars in economic analyses. The terms 'willingness to pay' and 'cost of time' refer to two concepts of approaches to estimating a value of time. (Author)

T322.0380 Kafoglis, Milton Z. "Highway Policy and External Economies," *National Tax Journal,* Vol. 16 (March 1963), 68-80.

Considers the concept of external benefits of highway investment as reflected in the problems of subsidy and determination of the non-user costs and benefits.

T322.0400 Kuhn, Tillo E. "Economic Concepts of Highway Planning." *Studies in Highway Engineering Economy.* Highway Research Board Bulletin 306. National Academy of Sciences – National Research Council. Washington, D.C., 1961, p. 81-121.

The paper discusses (a) the micro-economic treatment of highway projects, defined as the smallest units of decision-making; (b) program analyses where system effects, compatibilities of various projects in time or space have to be resolved; and (c) the micro-economic reconciliation of highway claims for resources with possible other demands for them. The analysis aims at rational resource allocation and attempts to provide economic criteria for the solution of broad transportation problems; for example, in a regional or metropolitan context. (Author)

T322.0420 Kuhn, T.E. "Use of Economic Criteria for Highway Investment Planning," *Highway Research Board Bulletin 222,* National Academy of Sciences – National Research Council, Washington, D.C., 1959, p. 49-74.

T322.0440 LeBaron, A.D. "'Theory' of Highway Finance: Roots, Aims, and Accomplishments," *National Tax Journal,* Vol. 16 (September 1963), 307-319.

Examines the effectiveness of suggested tax plans for narrowing the gap between the costs of investments in highways and benefits to users.

T322.0460 McCullough, C.B. and Beakey, J. "Time Element Benefits," *Economics of Highway Planning,* Technical Bulletin 7. Salem, Oregon, Oregon State Highway Department, 1938.

T322.0480 McDermott, J.M. *The Operational Effects of Automatic Ramp Control on Network Traffic.* Chicago Area Expressway Surveillance Project, Chicago, Ill. May 1966. (PB174 232).

Study of dynamic ramp metering on a section of the Eisenhower Expressway in Chicago showed an increase in effective volumes using the expressway, increase in average speeds and concomitant decrease in travel times, significant reduction in peak period congestion, and a decreased accident rate.

T322.0500 McKie, C.A. "Analysis of Benefits Accruing to the Motorist Through Shortened Distance and Surface Improvement," *Mississippi Highways,* Vol. XV, No. 8 (November 1946), 18, 26.

T322.0520 Mohring, Herbert and Harwitz, Mitchell. *Highway Benefits, An Analytical Framework.* Published for the Transportation Center at Northwestern University by the Northwestern University Press, Evanston, Illinois, 1962. An abbreviated version appeared in *Journal of Political Economy,* Vol. 69 (June 1961), 236-249.

The Highway Revenue Act of 1956 made a reality of the much discussed Federal Interstate System–a 40,000 mile network of limited access highway that, on completion in the 1970's at a cost of about $35 billion, will serve an estimated 20 percent of the nation's total highway traffic. In addition to providing for the Federal Interstate System, the 1956 Act established what is, for the Federal Government, a new concept of highway finance. By establishing a highway trust fund, this act provides an explicit linkage between Federal highway expenditures and highway-relation taxation.

Section 210 of the 1956 Highway Act required a five-(originally three-) year study to provide Congress with the information it deemed necessary before it could specify an equitable allocation of the costs of federally aided highway improvements. In 1961, the Bureau of Public Roads submitted a report summarizing its research together with that undertaken by state highway departments and many other agencies and individuals in response to this Congressional mandate. However, as this introduction is being written, Congress has yet to deliver its final judgment about how the costs of the Federal Interstate System and other federally aided highway construction can most equitably be allocated between the public at large and highway users on the one hand, and among various highway user classes on the other.

The subject of this monograph is therefore both timely and exceedingly important. The study deals with the nature and measurement of highway benefits and how their magnitude and distribution are affected by alternative financing systems. More specifically, its basic objective is to answer five broad questions:

1. How do the benefits of highway investment arise?
2. How can these benefits be measured in both principle and practice?
3. What are the mechanisms by which these benefits are distributed to individual members of the population?
4. What effects does the financing system adopted for highway improvements have on the magnitude and distribution of benefits?
5. To what extent can the existing body of research on the economic impact of highways be used to provide quantitative estimates of NET highway benefits? (Author)

T322.0540 Moyer, R.A. *An Analysis of Highway-User Benefits on California Inter-State System Resulting from Completion of a 10-Year Full Freeway Program.* University of California, Institute of Transportation and Traffic Engineering, Special Report 30. Los Angeles, University of California, 1955.

T322.0560 Munby, K.L. "The Roads as Economic Assets," *Bulletin of the Oxford Institute of Statistics,* Vol. 22 (November 1960), 273-297.

T322.0580 Highway Research Board of the National Academy of Sciences, National Research Council. Special Report 75. *Benefits to Utilities from Highway Locations.* Presented at the 41st Annual Meeting, January 8-12, 1962. Washington, D.C., 1962.

Contents – "Non-Vehicular Benefits from Utility Use of Streets and Highways" by James H. Lemly. "Economic Implications of Utility Use of Highway Locations in Utah" by Claron E. Nelson. "Benefits to Utilities from Rural Highway Locations in Oregon" by R.C. Blensly.

T322.0600 *Economic Analysis in Highway Programming, Location and Design.* Proceedings Workshop Conference on Economic Analysis, September 17-18, 1959. Washington, D.C., Highway Research Board, National Academy of Sciences-National Research Council, 1960.

Contents. – Session One–"Theory, Principles, Concepts, and Applications." – Session Two–"Current Practices in Economic Analysis." – Session Three–"The Determination and Measurement of Highway Costs." – Session Four–"The Determination and Measurement of User Benefits." – Session Five–"Determination and Measurement of Effects of Highway Improvements on Other than Direct Users of the Highways."

T322.0620 National Research Council, Highway Research Board. *Highway Economics.* January 1963, Washington, D.C., 1963.

Seven reports presented at the 42nd annual meeting–Committee on Highway Engineering Economy–Jan. 7-11, 1963.

T322.0640 Highway Research Board of the National Academy of Sciences-National Research Council. *Studies in Highway Engineering Economy.* Bulletin 306. Presented at the 40th Annual Meeting, January 9-13, 1961. Washington, D.C., 1961.

Contents – "Characteristics of Passenger Car Travel on Toll Roads and Comparable Free Roads" by Paul J. Claffey. – "Economy Studies for Highways" by Eugene L. Grant and Clarkson H. Oglesby. – "Economic Evaluation of Traffic Networks" by George Haikalis and Hyman Joseph. – "Cost Comparison of Four Lane vs. Stage Construction on Interstate Highways" by Robley Winfrey. – "Economic Concepts of Highway Planning" by Tillo E. Kuhn.

T322.0660 Nelson, Claron E. "Economic Implications of Utility Use of Highway Locations in Utah," *Benefits to Utilities from Highway Locations.* Highway Research Board Special Report 75. National Academy of Sciences-National Research Council, Washington, D.C., 1962, p. 33-51.

Use of highway right-of-way by public utilities presents a multi-facet cost vs. benefit vs. equity question. Reliable

information as to the costs and benefits is essential to the delineation of valid lines of consideration and the interpretation of the economic consequences of possible courses of action. Sampling surveys of operating procedures and records of Utah public utilities have thrown light on several aspects of these costs and benefits.

The alternatives available to the regulatory commissions or legislatures are limited to three 'pure strategies'–(1) complete prohibition of use of highway right-of-way by utilities, (2) permission to utilities to use right-of-way upon payment of some specified tax or fee, (3) free use of right-of-way by utilities–or a mixture of these 'pure strategies' for application to different types of roads and/or in different areas. A weighted combination of the economic implications of the 'pure strategies' indicates the aggregative economic effect for an area. (Author)

T322.0680 New York State Thruway Authority. *Substantial Operating and Maintenance Savings and Other Benefits that Accrue to Trucking Firms Using the New York State Thruway.* Albany, New York, New York State Thruway Authority, 1958.

T322.0700 Mohring, Herbert D. and Mitchell Harwitz. *An Analytical Framework.* Evanston, Ill., Northwestern University, 1962.

T322.0720 Northwestern University, Transportation Center. *The Nature and Measurement of Highway Benefits: An Analytical Framework.* Evanston, Illinois, Northwestern University, June 1960.

T322.0740 Portland Cement Association. *The Case for Concrete Highways in Minnesota.* Chicago, Ill. Portland Cement Association, 1957.

T322.0760 Reynolds, D.J. *The Assessment of Priority for Road Improvement.* Technical Paper No. 48. London, Road Research Laboratory, 1960.

T322.0780 Reynolds, D. "Some Problems of Planning the Improvement of the Road System," *Bulletin of the Oxford Institute of Statistics,* Vol. 22 (November 1960), 313-326.

T322.0800 Roth, G.J. *The Economic Benefits to be Obtained by Road Improvement, with Special Reference to Vehicle Operating Costs.* Report to the Rees Jeffreys Road Fund. R.N. 3426/GJR. Road Research Laboratory D.S.I.R., 1959.

T322.0820 Smith, Gerald W. "Benefit-Cost Ratios: A Word of Caution," *Highway Research Record,* No. 12. Publication 1109. Highway Research Board of the National Academy of Sciences-National Research Council, Washington, D.C., 1963.

In the evaluation of capital expenditure proposals for public projects, especially in highway facility planning, a method of comparing design alternatives called the benefit-cost ratio is widely used. The author offers a word of caution in the application of this method and makes a suggestion for those who compare the economy of design alternatives. The study of capital expenditure evaluation is generally referred to as engineering economy. (Author)

T322.0840 Stanford Research Institute. *Economics of Asphalt and Concrete for Highway Construction.* Menlo Park, California, Stanford Research Institute, 1961.

T322.0860 Stanford Research Institute. *The Impact of Improved Highways on the Economy of the United States.* Menlo Park, California, Stanford Research Institute, December 1958.

T322.0880 "Economic Effects of the New York Thruway", *Traffic Quarterly,* (April 1955), 220-227.

T322.0900 U.S. Bureau of Public Roads. *Final Report on the Highway Cost Allocation Study.* Letter from Secretary of Commerce transmitting . . . pursuant to Section 210 of the Highway Revenue Act of 1956. Washington, D.C., U.S. Govt. Print. Off., 1961.

Parts 1-5: Summary of findings, p. 3-14; General discussion of the study, p. 29-32; Available concepts and their relevance, p. 63-75; Comparable costs and benefits, p. 100-111; The cost-function study, p. 188-200; The differential benefit study, p. 200-224; Part 6: Data concerning the economic and social effects of highway improvement.

T322.0920 U.S. Bureau of Public Roads. *Progress Report of the Highway Cost Allocation Study.* Washington, D.C., U.S. Govt. Print. Off., 1957.

Methods of attack on the tax-allocation problem, p. 62-116.

T322.0940 U.S. Bureau of Public Roads. *Selective Bibliography on Value of Time, Comfort and Convenience.* Washington, D.C., U.S. Government Printing Office, 1958.

T322.0960 U.S. Bureau of Public Roads. *Supplementary Report on the Highway Cost Allocation Study.* Washington, D.C., U.S. Govt. Print. Off., 1965.

The differential benefit study, p. 212-234.

T322.0980 U.S. Congress, House. *Public Utility Relocation Incident to Highway Improvement,* Document 127. 84th Cong., 1st Sess., 1955.

T322.1000 Vaswani, R., "The Value of Automobile Transit Time in Highway Planning," Highway Research Board, National Academy of Sciences-National Research Council. *Proceedings,* 37: 56-68, 1958.

T322.1020 Vickrey, William W. *Optimization of Traffic and Facilities.* Unpublished paper. N.Y., Columbia University, May 1966.

The point is made that the highway user is not aware of the cost of his ride to society. The author proposes to use prices to control the use of highway facilities by discouraging the use of crowded ones. A pricing theory is presented which optimizes the use of facilities such as highways, railroad cars, busses.

T322.1040 Winch, D.M. *The Economics of Highway Planning.* Toronto, Canada, University of Toronto, 1963.

T322.1060 Work, John W., Jr. "An Economic Replacement Model for Highway Surface Determination." *Highway Research Record,* No. 12. Publication 1109. National Academy of Sciences-National Research Council. Washington, D.C., 1963.

This paper attempts to point out basic inadequacies in the conventional cost approach to highway surface-type determination, and subsequently, presents an economic replacement model couched within a highway framework. The conventional method relies heavily on a static concept of cost, whereas the proposed replacement model recognizes the value of funds over time; the first-mentioned approach requires a predetermined estimate of surface life, whereas the latter method is equipped to make an objective determination of surface life; the replacement approach, in an attempt to recognize all costs associated with the surface structure over its life, includes an estimate of road user cost not present in the HRB method.

Specifically, the model provides a surface replacement solution in terms of an optimum economic time span for pavement type (i.e., rigid or flexible) based on the minimization of an average cost stream over time, where the cost stream is made up of the initial surface structure cost and the anticipated stream of maintenance and road user costs. In this paper the anticipated stream of maintenance costs is simple regression estimates of these costs over the life of selected rigid and flexible pavement structures. The final solutions yielded by the model, in terms of present worth calculation, indicate the comparative total amounts of money needed today to build, maintain, and operate a flexible or rigid type surface structure over time. (Author)

T322.1080 Zettel, R.M. *Highway Benefits and the Cost Allocation Problem.* 43rd Annual Meeting of the American Association of State Highway Officials, Chicago, Illinois, November 1957.

URBAN

T400.0010 Office of the Budget Director, Department of the Comptroller. *Mass Transit Committee Proposal for Conversion of Street Cars to Buses.* Baltimore, Maryland, July 17, 1962.

T400.0020 Baltimore Transit Company. *Report for the Replacement of Fixed Wheel Vehicles of the Baltimore Transit Company with Air Conditioned Buses.* Baltimore, Maryland, Baltimore Transit Company, 1962.

T400.0040 Baltimore Transit Company. *Revised Program of Improved Transit Service for Baltimore Metropolitan Area.* Baltimore, Maryland, Baltimore Transit Company, 1962.

T400.0060 Berkley, George, "Municipal Garages in Boston: A Cost-Benefit Analysis," *Traffic Quarterly,* Vol. 19 (April 1965) 213-228.

T400.0080 Great Britain, Ministry of Transport. *Traffic in Towns.* Appendix 2, "Cost Benefit Analysis and Accessibility and Environment," 1963.

Informally called the *Buchanan Report.*

T400.0100 Committee for Economic Development. *Developing Metropolitan Transportation Policies: A Guide for Local Leadership.* A Statement on National Policy by the Research and Policy Committee. Washington, D.C., 1965.

Principles for Government decisions on transportation, p. 35-45.

T400.0120 Fitch, Lyle C. and Associates. *Urban Transportation and Public Policy.* Institute of Public Administration, New York. Prepared for the U.S. Department of Commerce and Housing and Home Finance Agency. San Francisco, Calif., Chandler Publishing Company, 1964.

Cost-Benefit analysis and expansion of transportation facilities, pp. 58-61.

T400.0140 Foster, C.D. and Beesley, M.E. "Estimating the Social Benefits of Constructing an Underground Railway in London." *Royal Statistical Society Journal,* Series A, Vol. 126, Pt. 1, (1963), 46-93.

This paper gives the findings and method of a study estimating the gains and losses expected to result from building the Victoria Line–whoever gains, or suffers the losses, i.e., the social benefits and social costs of the Line. The ambition and method are essentially the same as in earlier water resource and transport studies where the aim was also to measure the surplus of social benefits over social costs expected to result from an investment; or, as it is sometimes called, the consumers' surplus return on investment. In effect, the purpose of the study is to measure the effect on the community of the investment, so far as practicable.

The Victoria Line (V.L.) will be a London Transport Underground railway from Victoria at its southern end to Walthamstow in northeast London. First proposed as part of the London Plan Working Party's Route C (B.T.C. 1949), its construction was authorized by the Treasury in August 1962. It will be the first underground railway built in central London since before 1914. (Author)

T400.0160 Great Britain, Ministry of Transport. *Traffic in Towns.* London, 1963.

Buchanan Report.

T400.0180 Haikalis, George and Campbell, E.W., "Evaluating Urban Transportation Systems," *American Society of Civil Engineers Proceedings, Journal of the City Planning Division,* Vol. 89. No. CP1, Paper 3626, September 1963, 1-15.

Uses the development of highway and transit plans by the Chicago Area Transportation Study to demonstrate the applications of cost-benefit analysis techniques.

T400.0200 Lemly, James H. "Non-Vehicular Benefits from Utility Use of Streets and Highways," *Benefits to Utilities from Highway Locations.* Highway Research Board Special Report 75. National Academy of Sciences–National Research Council, Washington, D.C., 1962, p. 1-32.

In keeping with sound economic objectives, National policy in recent years has tended to support the philosophy that costs of Federal-aid highways should be paid for by

those who receive benefits from these highways, whether this applies to vehicular users or other categories that might emerge. But measurement of these benefits has proved to be difficult. When the Congress passed legislation to provide for the new National System of Interstate Highways, it was believed that neither the public nor the Congress was able to judge as to the degree of benefits which highways provided to the various groups within the Nation. To obtain the necessary data to act intelligently on this matter, the Congress directed the Bureau of Public Roads to initiate studies to develop background information on highway benefits and to provide this information to the Congress and the Nation. Thus, the immediate cause for this study was the request of the Congress that the Bureau of Public Roads undertake a series of studies of benefits to vehicular and non-vehicular users of the Nation's highways. The specific request was made of the Bureau in Section 210 of the Highway Revenue Act of 1956. (Author)

T400.0220 Baltimore City Planning Commission. *Study for East-West Expressway.* Baltimore, Maryland, Baltimore City Planning Commission, 1960.

This is a non-technical, but thoroughly adequate, cost-benefit analysis of a proposed north-east throughway for Baltimore. It also contains the usual traffic-plan discussions of property values and tie-ins with other local means of transportation.

T400.0240 Baltimore City Planning Commission. *Transportation Plans.* Baltimore, Maryland, Baltimore City Planning Commission, 1959.

T400.0260 Baltimore Urban Renewal and Housing Agency. *Plan for Rendering Relocation Advisory Services and Procedure for Reimbursing Relocation Cost in Federal Aided Highway Projects.* Baltimore, Maryland, Baltimore Urban Renewal and Housing Agency, n.d.

T400.0270 Beesley, M.E. and Kain, J.F. "Urban Form, Car Ownership and Public Policy: An Appraisal of Traffic in Towns," *Urban Studies,* Vol. I, No. 2 (November 1964), 174-203, 1964.

T400.0275 Greater Baltimore Committee, Inc. *Proposal for a Mass Transportation Study for the Baltimore Metropolitan Area Mass Transit Legislative Commission.* Baltimore, Maryland, Greater Baltimore Committee, Inc., 1949.

T400.0280 Maryland Port Authority. *Proposed East-West Expressway and the Port of Baltimore.* Baltimore, Maryland Port Authority, 1962.

T400.0300 Meyer, John R., Kain, J.F., and Wohl, M. *The Urban Transportation Problem.* Cambridge, Harvard University Press, 1965.

Part II discusses methods to determine the costs of providing various services at different volume levels, for different route lengths and under specified conditions of speed, frequency, convenience, and comfort.

T400.0320 Mohring, Herbert, "Urban Highway Investments," *Measuring Benefits of Government Investments,* ed. Robert Dorfman. Papers presented at a conference of experts, November 7-9, 1963. Washington, Brookings Institution, 1965, p. 231-291.

Differences and similarities between highway development and the development of other peakload industries are discussed. Experiments are mentioned which attempted to measure the benefits of driving, highways, and public transportation in an attempt to price them fairly. A marginal value approach is used to derive methods of pricing highways so as to insure their maximum utilization. The only economies of scale found to exist consisted of subsidies to already existing rapid transit systems. Highway costs and benefits are claimed to be largely insulated from the market.

T400.0340 Moses, L.N. and Williamson, H.F. "Value of Time, Choice of Mode, and the Subsidy Issue in Urban Transportation," *Journal of Political Economy,* Vol. LXXI, (June 1963), 247-264.

T400.0360 Tri-State Transportation Commission. *Coordinated Bus-Rail Service.* New York, June 1965. (PB-174-313)

Mass transportation demonstration project designed to determine whether coordinated bus-rail service will attract substantial journey-to-work and off-peak traffic when several alternatives are available.

T400.0380 Tri-State Transportation Commission. *Coordinated Bus-Rail Service Rockland County–Westchester County–New York City.* New York, January 1967. (PB-174-313)

Results of study indicate that a feeder bus service, essentially of a short-haul nature must find substantial off-peak use or be subsidized if it is to provide peak-hour shuttle service at reasonable cost to the user.

T400.0400 U.S. Bureau of Public Roads. *Pittsburgh Area Transportation Study.* Final Report in two parts. Study conducted under the sponsorship of the Commonwealth of Pennsylvania, County of Allegheny, City of Pittsburgh, Pittsburgh, Washington, D.C., 1961.

Techniques of transportation planning, v.2, p. 80-103.

T400.0420 Vickrey, William W. "Pricing As a Tool in Coordination of Local Transportation," *Transportation Economics, A Conference of the Universities–National Bureau Committee for Economic Research.* New York, National Bureau of Economic Research, 1965.

Pricing is recommended as a means of holding the use of transportation facilities down to capacity by, e.g., charging drivers for the use of streets, etc.

T400.0440 Vickrey, William S., "Revising New York's Subway Fare Structure," *Operations Research for Management.* Baltimore, Maryland, The Johns Hopkins Press, 1956.

The New York subway system's utilization could be optimized by a fare system under which the rider pays for the marginal cost of his ride. Thus a rider going against the rush-hour traffic should pay nothing, while a rider going with the rush-hour traffic would have to pay for the extra equipment necessitated by his peakload ride as well as for the equipment and services necessary at non-peakload hours.

To implement this approach everyone would pay 25¢ upon entrance and receive a metal token with his station of embarkation and the time. Upon leaving the subway a machine would give him a refund in exchange for his token. This is a very interesting example of marginal cost pricing and contains all necessary facts and calculations to enable the reader to apply it to his own marginal cost situation.

T400.0460 Wilbur Smith and Associates. *Baltimore Metropolitan Area Transportation Study.* Baltimore, Wilbur Smith and Associates, 1962.

T400.0480 Witheford, David K. *Investigation and Description of Benefit-Cost Analysis Procedures.* Technical Paper No. 32. Pittsburgh, Pittsburgh Area Transportation Study, 1962.

Discusses the application of evaluation techniques for highway systems developed by the Chicago Area Transportation Study.

OTHER COUNTRIES

T500.0020 Brown, Robert T. "The 'Railroad Decision' in Chile," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 242-270.

"The thesis of this paper is that a decision to construct a national railroad is fundamentally different from a decision to construct either a highway or a port. A port or a highway investment decision is similar to a decision to build a branch line on an existing railroad or to replace locomotives or rolling stock. These are marginal investments and can be evaluated using traditional project evaluation techniques. If the decision is erroneous, the economy suffers a loss, and if the erroneous port or highway investment decision involves a substantial part of the total investment budget, the loss will be important. For the reasons outlined at the beginning of the paper, however, erroneous decisions in these transport media are not likely to distort the basic transportation structure of a nation for any great length of time." (Author)

T500.0040 Hawkins, E.K. *Roads and Road Transport in an Underdeveloped Country. A Case Study of Uganda.* Colonial Office Research Study No. 32. Colonial Office, London, 1962.

T500.0060 Hunter, Holland. "Transportation in Soviet Development," *Transport Investment and Economic Development,* ed. Gary Fromm. Washington, D.C., The Brookings Institution, Transport Research Program, 1965, p. 123-143.

One could sum up this discussion by saying that Soviet experience shows how frugality in transportation development can contribute to rapid industrialization. The record is one of success, not failure. Respect for Soviet performance is, if anything, heightened by a recognition that planning has not proved to be a magic key to optimum solutions. Furthermore, nationalization, while it may have shifted questions to different offices, has not provided elegant and efficient answers to the basic questions in this field. Soviet planning methods and operating procedures in the 1928-1940 period were crude. Advances in programming techniques should enable currently developing economies to plan and manage the development process with less cruelty and waste of resources than the U.S.S.R. has experienced. Moreover, input-output and linear programming methods are receiving extensive development at present in the U.S.S.R.; their application to the Soviet economy can thus facilitate (though it cannot guarantee) more humane and efficient economic performance in the U.S.S.R. as well. (Author)

INDUSTRY

Management

I000.0100 "Peak-Load Pricing and Optimal Capacity Under Indivisibility Constraints," *American Economic Review,* Vol. 56 (September 1966), 810-27.

I000.0150 Ball, Leslie W. "Systems Effectiveness Assurance of Management," *Systems Effectiveness,* U.S. Department of the Navy, Office of Naval Material, Systems Effectiveness Branch. Washington, D.C., January 1965.

I000.0200 Byrne, F.P., Agnew, F.R., Goldstein, R.P., Kriege, O.H. and McKeever, R.J. *Development of a Multipurpose Kit.* Third Report, Phase III. Pittsburgh, Pa., Westinghouse Electric Corporation, May 1965.

Value analysis and human factors developments are investigated in conjunction with an engineering study.

I000.0240 Christie, Lee S., "The Organization of Information Routing," *Operations Research for Management.* Baltimore, Maryland, The Johns Hopkins Press, 1956.

Experiments prove that the structure of a communications network within an organization can in itself cause certain effects to be obtained.

I000.0250 Cohen, Kalman J. and Hammer, Frederick S. *Analytical Methods in Banking.* Homewood, Illinois, Richard D. Irwin, 1966.

I000.0260 Day, Ralph L. "Optimizing Marketing Research Through Cost-Benefit Analysis," *Business Horizons,* (Fall 1966), 45-54.

I000.0265 Dykeman, Frank C. "New Techniques for a Management Information System," *Financial Executive,* (March 1966), 46-52.

A management information system is much broader than a series of accounting reports, for it comprehends all information available to executives from sources both internal and external, formal and informal, as well as personal contacts between executive and management personnel. It uses information and knowledge gained through years of experience which often form the basic background for intuitive business decisions. However, management accounting reports are still the essential ingredients of the formal information system.

Through EDP, the preparation of accounting reports soon enough after events are reported can make possible management action based on the reports that will influence the situation under consideration. Thus, accounting information is transformed from an historically oriented communication device to a tool for reporting a current activity, as well as a factor that will influence the future courses of the company. Computers also make possible vast calculations required for penetrating analyses, the applications

of mathematical techniques in optimization studies, the simulation of business operations, and the use of other mathematical methods for arriving at informed decisions.

Industrial engineers, mathematicians, and others engaged in operations research are participating with the accountant in improving accounting communications. Use of measurement criteria permits the accountant to identify areas requiring management attention and thus makes exception reporting possible and responsibility accounting more useful.

A simulation example is given for a situation involving optimum staffing of a key punch section. The classical Economic Lot Size formula is defined and its use is explained. Finally, the technique of discriminant analysis is shown as applied to a credit problem.

I000.0270 Filgueira, Carlos. *El Empresario Industrial en America Latina.* Santiago, Chile, Instituto Latinoamericano de Planificacion Economica y Social, n.d.

I000.0285 Freeman, Raoul J. *Developments for Modern Management.* P-3210. The RAND Corp., Santa Monica, California, August 1965. (DDC No. AD 619-982).

Prepared for presentation at the Annual Joint Western Regional Meeting of the Institute of Management Science and Operations Research Society of America (7th). 29-30 April 1965.

The address is given that expanded on the theme of the 7th Annual Joint Western Regional Meeting of the Institute of Management Science and The Operations Research Society of America, Los Angeles. April 1965. On the program for the meeting were discussions as to (1) the developments during the next 10 years in operations, research management science (2) future trends in data processing and computers, and (3) computers and management decisions, distribution and inventory, marketing, simulation, management systems, cost/effectiveness information economics and finance.

I000.0300 Gallagher, Paul F. *Project Estimating by Engineering Methods.* New York, Haydon Book Company, 1965.

Contains a detailed description of cost-estimating methods applicable to quantity production. The methods described for developing cost estimates of manpower and materials entail the pricing of labor hours and bills of materials. Five methods of estimating are outlined, four of them as preliminary to the fifth, which combines two elements: standard hours and the learning curve. A discussion of the learning curve is included, describing its history, use and construction. Appendices are included to present period distribution curves and learning curve tables.

I000.0310 Geisler, Murray A. and Steger, Wilbur A. *The Combination of Alternative Research Techniques in Logistics Systems Analysis.* P-2660. The RAND Corporation, Santa Monica, California, 1962.

Considers the problem of selecting techniques to use in a systems analysis, drawing examples from supply and inventory systems problems.

I000.0350 General Electric Company, Hanford Atomic Products Operation. *Programming.* HW-80560F. Monthly Report. Richland, Washington, The General Electric Company, February 14, 1964.

The economics of using various combinations of U, Th, and Pu isotopes as nuclear fuels are outlined. A summary is presented of analyses of conversion of small production reactors to power reactors; seed-blanket reactors; Pu fuels, recycle, and conservation; and development of pertinent computer codes (JASON, MELAEGER, and ALTHAEA). Emphasis is placed throughout on Pu utilization. (T.F.H.)

I000.0400 Gradwohl, Alan J. *Inventory Policies for a Multi-Echelon Supply System with Fixed Order Costs at Lower Echelons.* PRC R202. Planning Research Corporation, Washington, D.C., April 1961. (DDC No. AD 408-521).

This report concerns the problem of approximating optimum (least-cost) inventory policies for a multi-echelon supply system with fixed order costs at lower echelons. First, the technique for computing the approximate policies is explained in nonmathematical terms. The sensitivity of these policies, and their resulting costs, to changes in parameter values is then investigated. Finally, the effect of implementing these approximate policies in a multi-echelon supply system is studied in an effort to determine the cost increase over the theoretically optimum cost. The resulting cost increase is less than 3 percent for a typical inventory. (Author)

I000.0420 Hertz, David Bendel and Feeney, George J., "Operational Organization," *Operations Research for Management.* Baltimore, Maryland, The Johns Hopkins Press, 1956.

Discusses the uses to be made of operations analysis by management. Operations analysis enables technical personnel to analyze and present data in a form that allows management to make quick decisions and to be aware of the possible results of any given decision.

I000.0450 Green, P.E. "Statistical Decision Theory in New Product Development," *Chemical Engineering,* Vol. 69, Fall 1962.

I000.0451 Hippenstiel, R. "Inter-Firm Comparison," *Chartered Mechanical Engineers,* Vol. 12, No. 9 (September 1965), 452-456.

All assessments of efficiency must be based on comparison of some kind; since long-run criterion of firm's success is its competitive position within its industry, most significant comparison is that with its competitors; inter-firm comparison is technique which provides sufficient key data from number of firms within industry – on basis of complete anonymity – to enable each management to measure its relative performance against that of its competitors; method is based on comparison of cost vs. output, comparison of productivity, and on comparative analysis of system of technical and economic ratios reflecting conditions for participating firms.

I000.0452 Greer, Carl Crawford. *A Benefit-Cost Model for Credit Decisions.* N.Y., Columbia University, 1966.

Benefit-Cost analysis is used to build a model to enable credit managers to make decisions on accepting or rejecting credit applications, budgeting for losses due to credit, the need for additional capital to finance credit selling, the costs of running a credit department, etc. The model was tested in a mail order company.

I000.0500 Hill, L.S. "Towards a Coordinated Approach to the Structuring of Cost and Design Models: A Case Example," *Operations Research,* Vol. 13, No. 4 (July-August 1965), 619-631.

The use of airships for the transportation of outsize commodities is used as a case study in the application of cost models. The use of a system cost model is described as being important for the engineering development effort. The case study examines the cost differential for airships with varying design payloads, different speeds, power and other characteristics. Cost equations are included for research and development costs, investments and operating expenses.

I000.0510 Jones, J.J. "Application of Aerospace Procedures to Civilian System Selection," Paper 65 -WA/AV-3 for meeting November 7-11, 1955.

Paper shows how 'systems approach' generally applied to solving defense and space problems, can be successfully applied to other problems; outline of basic steps of systems analysis is presented, and sample problem is used to illustrate how they would be applied in a specific case such as supplementing present auto-freeway system and initiating long-term development in metropolitan city.

I000.0550 Igo, D.J. *Industrial Classification and Economic-Impact Analysis.* Research Analysis Corp., McLean, Va., May 1966. (DDC No. AD 481-600).

Examines the suitability of the Standard Industrial Classification (SIC) and related product and enterprise classifications for measurement and analysis of the impact of defense expenditures. Outlines the types of measurement required, and describes the criteria used for appraising the classification systems examined. Also describes the SIC and related systems, reviews their advantages and limitations for use in economic-impact analysis with emphasis on the relative merits of industry as opposed to product classification, and presents supplementary enterprise classifications for impact analysis.

I000.0555 Johnson, R.A., *et al. The Theory and Management of Systems.* New York, McGraw-Hill, 1963.

I000.0560 Joyce, C.C., Jr. *Models: A Method for System Planning.* Mitre Corporation, Bedford, Massachusetts, 13 July 1962.

One aspect of system planning is the identification of promising technical approaches for meeting future military needs. Planning studies of this type may be thought of as the construction of certain models of reality, which are then manipulated to indicate the relative value of various technical approaches. Division of labor and specialization of personnel were accomplished in the planning study by defining specialized sub-models which are relatively independent. Five sub-models are suggested: a cost model, a technical model, an operational model, a strategic model, and a value model. The time sequence of activities in the planning process is considered. Recommendations are made for future development of a planning method.

I000.0570 Macy, Josiah, Jr., "Processes Affected by Noise and the Confusion of Meanings," *Operations Research for Management.* Baltimore, Maryland, The Johns Hopkins Press, 1956.

An attempt is made to deal mathematically with the effects of individual quirks on group behavior and the results of business procedures.

I000.0600 Meek, Ronald L., "The Allocation of Expenditure in the Electrical Supply Industry: Some Methodological Problems," Peacock, Alan T. and Robertson, D.J., eds., *Public Expenditures: Appraisal and Control.* Edinburgh, Oliver and Boyd, 1963, p. 36-60.

I000.0650 Mosbaek, E.J. *Handbook for Applying Expedient Unit Cost Estimating.* RM-59-TMP-2. General Electric Company, Santa Barbara, California, Technical Military Planning Operation (TEMPO), January 1959.

A method for estimating unit costs at varying production levels is illustrated in this report, which also outlines the techniques described in TEMPO RM-58-TMP-69, "Expedient and Reliable Unit Cost Estimating." The general approach is to derive the unit cost for a specified production level, referred to as the "first cost estimate," and then to use the information for the rapid calculation of other cost estimates. The procedure is outlined in five steps. The first three are used to develop adjusted costs for five groups of vendor products, the fourth to adjust labor and material costs, and the fifth to sum costs.

I000.0750 Organization for Economic Cooperation and Development. *Budgetary Control.* Paris, OECD, January 1959.

An effective tool for the management of small and medium-sized enterprises.

I000.0799 McCloskey, Joseph F. and Coppinger, John M. *Operations Research for Management.* Baltimore, Maryland, The Johns Hopkins Press, 1956.

This book consists of case studies in operations research. As such, parts of it are useful in calculating costs for alternate projects under a cost-benefit analysis. In addition it contains five papers than can properly be called papers in cost-benefit analysis. They are described separately elsewhere in the list.

I000.0800 Orr, Daniel. *Production Stability and Inventory Variation. Production Change Costs and their Effect Upon Inventory and Production Policy.* Princeton, New Jersey, Princeton University, May 13, 1960. (DDC No. AD 240-299).

I000.0850 Thompson, Ivan B. and Harold A.W. Tibbs. *Analysis of the Costs and Benefits of Electronic Data Processing Systems.* Master's thesis. Air Force Institute of Technology, Wright-Patterson AFB, Ohio, School of Systems and Logistics, June 1963. (DDC No. AD 424-885).

This thesis presents a conceptual analysis of the costs and benefits of alternative management information systems. Much remains to be accomplished before decisions can be made with the assurance that the alternative selected will either produce the most for a given cost or achieve a given objective at least cost. Further research is required to develop cost and value techniques and factors for use in making accurate, advance estimates of the costs and value of proposed management information systems. Additional study is also necessary to create effective procedures for developing electronic data processing proposals under the concepts presented in this study. The mathematical models required in the simulation of the environments in which the many material management information systems operate must also be developed.

I000.0900 Turvey, Ralph, "On Investment Choices in Electricity Generation," *Oxford Economic Papers,* Vol. 15 (November 1963), 278-286.

Illustrates the nature of complications in determining cost and benefits of one component in a system, using as an example the Mackenzie report on "Electricity in Scotland."

I000.0902 McMillian, Claude and Gonzoles, Richard F. *Systems Analysis, A Computer Approach to Decision Models.* Homewood, Illinois, Irwin Press, 1965.

This is an excellent but, unfortunately, mistitled book. The title should be "A Simulation Approach to Basic Management Science." The book does not take a broad systems approach to either management or to information systems. Also, it has nothing to do with EDP systems analysis. It does, however, manage–in a lucid way–to introduce three very basic topics: FORTRAN Programming, some Management Science techniques, and Simulation. Simulation is introduced both as a problem-solving technique and as a method of clarifying some formal management science models for people who may find purely mathematical developments a bit mysterious. It would have been more educational to develop these techniques mathematically along with the simulations, but this is not done. The book starts with introductory chapters on Systems and Models and on Simulation. Basic FORTRAN is introduced.

The book then covers the following Managment Science topics: inventory reordering both under certainty and under uncertainty, queuing, PERT project planning technique, and finally touches on the use of simulation to study entire firms. Interwoven with this series of management science techniques, in a way which could motivate students to learn them, are probability and simple statistical concepts. Advanced FORTRAN operations are also brought in as needed. Simulation techniques are presented, including random number and variable generation, a complete program for simulating a simple queuing situation and an introduction to Industrial Dynamics. (The term Monte Carlo is used, but the book does not touch on mathematical Monte Carlo methods, which is no loss in the context of management science.)

The book concludes with an example of a simplified simulation of a complete company and some pertinent comments on the problems of experimenting with simulation models.

I000.0950 Vaswani, Ram. "The Value of Irreducibles in the Planning of Service Systems," *Operations Research Journal of the Operations Research Society of America,* Vol. 6, No. 5 (September-October 1958), 740-765.

I000.1000 Mosbaek, E.J. *Expedient and Reliable Unit Cost Estimating.* RM-58-TMP-69, (TEMPO), General Electric Company, Santa Barbara, California, Technical Military Planning Operation, December 1958.

This report summarizes a study on unit cost estimating. A method is described for calculating the unit cost as a function of the quantity produced. The method is designed for costing complex electronic components that are characterized by high purchase parts costs relative to other costs of production. The report describes how the unit cost for any level of production can be approximated by a weighted sum of three or four group costs. The weights are provided in a table. The method can also be used to determine the difference in production cost for alternative production scheduling.

I000.1500 Pun, Lucas and Peschon, John, "The State of the Art of Automatic Control," *Disciplines and Techniques of Systems Control,* Vol. 3, No. 36, Citation No. 43, n.d.

This is an introductory chapter to the following ones. After some historical review of the field of automatic control, the authors emphasize the trend toward unification in education or research in the field of automatic control. They state that this trend gives it the character of a science or an art, and it is not an appendix to various engineering curricula. By the examples cited, namely, numerical control, traffic control and production control, the reader will recognize that automatic control science is now wide-spread in all fields and that the natural generalization of classical closed-loop feedback systems extends to optimizing or adaptive systems. Next, the design methodology of the automatic control systems with complex structure is explained. In the third section, modeling and identification problems are briefly reviewed and the idea of state space approach for continuous and discrete systems is introduced. It is pointed out that this approach now supersedes the Laplace-transform method. In the fourth section, the classification of the adaptive systems is presented. The system is lumped into four blocks; computer (including controller) C, actuator A, process P and identification I; and these form the loop. The adaptive systems are classified by the number of this loop. A performance index is associated with each I block. Hence, an ordinary feedback system is regarded as an adaptive system of first degree. The economical structure corresponding to the systems is clearly argued; and the distinctions among optimum, adaptive optimizing and learning systems are clearly explained. In the fifth section, analytical methods are surveyed as an introduction to the following chapters, referring to the bibliography. In the last section, the direction for research is suggested. The authors predict that the automatic control systems will become more and more complicated, and that the field will not be limited to the conventional system, but will be extended to the systems that include sociology, biology or medicine.

This chapter is a proper introduction, and the description is clear and well defined. The fact that the word 'computer' appears everywhere is evidence of its important role in the field of system analysis and design. Figures 1, 2 and 7 may be unified.

I000.2000 Radamaker, T., (ed.). *Business Systems, Vols. I and II.* Systems and Procedures Associates, Cleveland, Ohio, 1963.

This two-volume book has already (and rather amazingly) been adopted for use in more than 30 universities and colleges throughout the United States, and has therefore, been tested in actual classroom situations. Although designed for classroom teaching, the book is also intended as a reference work for every systems professional, and for in-company training of new systems personnel.

Volume I covers, 'Management and Systems'; 'Organization Concepts and Design'; 'Systems Functions Concepts and Programs'; 'Survey Imitation and Fact Gathering'; 'Charting'; 'Office Layout'; 'Systems Analysis'; 'Selling the Systems'; 'Installation and Follow-up'; 'Formalizing'; 'Forms Analysis and Design'; and 'Administrative Work Measurement'. Volume II consists of material on 'Forms Administration'; 'Records Management'; 'Office Tools'; 'Keyboard Accounting Machines'; 'Peripheral Devices'; 'Punched Card Machines'; 'Electronic Data Processing'; 'EDP Feasibility and Installation'; 'Integrated Information Systems'; 'EDP Equipment Applications'; 'Information Retrieval'; 'Operations Research'; and 'Systems Planning and Control'. Both volumes have appendices of case studies.

Most of the material in these volumes is rather general and well-known to professionals. The set suffers only slightly from a discontinuity between successive papers.

I000.2100 Sveistrup, P. "The Systems Concept and the Enterprise as a System," *Nordisk Tidskrift for Informationsbehandling,* Vol. 5, No. 4 (1965), 256-275.

This paper concerns a study initiated by the need for a generally applicable methodology for systems analysis in automation of business administration. The requirements are briefly discussed of a general conceptual framework to make it useful as a reference system for the development of a theory of administration. A so-called box-and-ball technique is used to describe a few purely abstract models of elementary units in the administration system of an enterprise. Finally, an attempt is made to apply the technique in a general description of the enterprise as a system.

I000.2200 "Systems Concept: Another Management Revolution?" *Steel,* Vol. 154 (June 15, 1964), 25-27.

Highlights of first Systems engineering conference and Exhibition, New York.

I000.4000 Vergin, Roger C., University of California, and Grimes, Andrew J. "Management Myths and EDP," *California Management Review,* (Fall 1964), 59-70.

This article gives some results of a computer installation study of eleven firms in the Minneapolis-St. Paul area. The authors found similar misconceptions about office automation among management. In all the companies not one firm had a truly integrated EDP system, but in nearly all the firms the managers stated that they had achieved this goal. There was very little immediate job elimination or displacement, yet many managers gave reduced labor cost as the main reason for acquiring computers. Job reduction, a pre-installation objective in nine of the eleven firms, ranged from less than one percent to approximately ten percent of the total employment of each firm. However, in individual operations or sections within the firms as many as 80 percent of the jobs were eliminated.

The employables, not the employed, feel the impact of the computer the most. However, 'empirical research is lacking: the topic has not been fully explored. A prime determinant of the eventual impact on employment is the degree of computerization, certain theoretical programing limits are known. The upper limit for any programing effort is reached when the task is of such a nature that it is impossible to determine or calculate any one of these three factors: (1) relevant variables pertaining to a task, (2) the interaction among these variables, and (3) the results of the interaction. It is impossible to estimate what proportion of the activities of any given firm fall within these limits.'

It is difficult to predict to what extent programing will extend beyond clerical function into managerial decision making. 'Any attempt to estimate quantitatively the potential use of the computer is of doubtful validity. Even if it were known which tasks could be programed, it is impossible to predict how many it would be economically feasible to program . . . . Up to the present it has also been difficult to determine precisely the impact of the computer on employment because of concurrent changes, lack of adequate records, and management's policy of avoiding lay-offs–a policy which management has been able to employ because of the high turnover safety valve.'

The computer is often associated with disruptive employment changes which give rise to retraining, upgrading, downgrading, transfers, etc. In the survey, downgrading of jobs was a more common and serious occurrence than the other possibilities. The managements of the firms surveyed did not consider up- and downgrading as significant factors in the use of computers.

Errors are extremely rare, a machine fajlure is nearly unknown. In all the firms in the study, machine malfunction or unscheduled downtime was insignificant. Few errors in logic exist after extensive simulation runs with realistic data. Input errors are usually prevented in the same manner. For many firms reduction of the high cost of clerical errors occurring under the old system was a major objective in computerization. After extensive testing and debugging with simulated data, the computer systems were far more accurate than the old systems, and long parallel operations were not required. Firms installing computer systems encountered, and are still encountering, considerable difficulty in writing programs. Almost everyone significantly underestimated the difficulty, time, and money involved. It is not easy to estimate the difficulty of programing, the optimistic estimates of computer vendors are often taken at face value, and basic operations of the firm are often more difficult to analyze than originally thought. 'The difficulties encountered in programing partially depend on the ability of the staff to perform the system analysis and programing.'

Externally selected system analysis had extreme problems in gathering the information necessary to perform their jobs. While it is generally felt that system analysts should be hired from within the firm, this consensus does not exist for programers. Opinions vary as to desirable backgrounds (college degree vs. anyone who can pass an aptitude test), but there is agreement concerning the personal characteristics of a good programer: a logical systematic approach to problem solving, extreme accuracy, obsession for detail, and a creative imagination. The most important characteristics of a systems analyst is persuasiveness. There is agreement that it takes considerable time to train a programer, but little agreement on how much time. It seems unlikely that an untrained programer will make any position contribution to his form in less than six months.

Nearly every firm stated that the ability to expand clerical production with minimum additional labor was a primary objective in their acquisition of the computer. A definite limitation, in both the short and long run, is the lack of flexibility of the computer system. Changes or even minor additions in the data processing requirements may necessitate a substantial revision of the entire computer system.

The authors feel that 'the major part of the blame (for failures) must be placed on poor planning and execution of the computer effort,' and that even the vast majority of the 'successful' installations have failed to capture the full potential of the computer.

Systems Costs

I100.0000 Fehr, F.W. "Some Points to Watch in Studying the Fluctuation of Cost with Volume," *NAA Bulletin,* March 1960.

Contains a discussion of cost-quantity relationships. The nature of fixed and variable costs is examined. Costs are described as remaining fixed by (1) management decision, (2) their inherent nature, or (3) interpretation of accounting policy. The time element is important in-as-much as costs fixed in the short run may be variable in the longer run. Some costs, such as material inputs, vary automatically with the activity; others, such as direct labor, vary as a result of management decision. Degrees of variation and stepped costs are discussed.

I100.0001 Mason, Philip J. *An Analysis of Retail Distribution Systems.* Master's Thesis. Naval Postgraduate School, Monterey, California, 1964. (DDC No. AD 481-361).

The rise of the Defense Supply Agency and the General Services Administration as significant factors in the wholesaling of military material emphasize the need for skillful

management of those broad aspects of the supply system remaining under Navy control. The largest such aspect is retail distribution, and the functional relationship between the Navy consumer and the supply activity in direct support of that consumer. This paper describes the advent and growth of self-service as a tool of retail distribution, defines alternative techniques, proposes a means of comparing the cost effectiveness of the various methods, and illustrates this means of comparison through a hypothetical situation. The primary argument is not for a particular system, but that all systems must be carefully and objectively analyzed prior to commitment to one alternative or another.

I100.0100 Andrastek, Donald A., Belding, Reginald R. and Wollaston, James W. *Cost and Effectiveness Evaluation of Automated Cargo Delivery Systems in Army Aircraft.* Douglas Aircraft Company, Inc., Aircraft Division, Long Beach, California, June 1966. (DDC No. AD 637-158).

Methodologies were developed to measure the degree of automation of cargo handling systems and a cost effectiveness study was made of the automation of cargo handling. Several cargo handling systems were evaluated. These systems ranged from manual to highly automated. Elements not affected by the type of system were held constant wherever possible.

I100.0150 Bass, Bernard M., McGhee, Walter P. and Vaughan, James A. *Three Levels of Analysis of Cost Effectiveness Associated with Personnel Attitudes and Attributes.* Technical report. Pittsburgh University, Pennsylvania, July 1965. (DDC No. AD 619-460).

I100.0167 American Management Association. *Cost-Effectiveness--A New Management Tool: What It Is and How to Use It.* Administrative Services Briefing Session No. 6316-01, n.d.

I100.0200 Carlisle, Robert M. *A Cost Sensitivity Analysis of Major Design Characteristics of GHOST and SCOMO Meterological Systems.* Bendix Systems Division, Bendix Corporation, Ann Arbor, Michigan, November 1965. (DDC No. AD 477-205).

Examines the cost and design variables of a satellite system designed to relay data from a global network of free-floating balloons or from a network of sea and land-based meteorological stations to the weather bureau central data processing station in Suitland, Maryland. The cost of other systems can be determined from the data developed in this report.

I100.0300 Clark, Henry, Benford, Harry, Bortz, Nelson, Collins, Dale and Elden, Rodney M. *Shipboard Systems Costs: A Functional Analysis of Work Aboard Ship.* MTRB Ship Number 5, A Tanker in Domestic Service. National Academy of Sciences-National Research Council, Shipboard Mechanization/Manpower Comm., Washington, D.C., August 1966. (DDC No. AD 637-786).

One report in a series of similar studies aboard 20 different merchant ships. Includes also a system for the retrieval and analysis of data required for the effective management of a ship.

I100.0350 Dennis, Albert E. *Managing the Cost Aspects of Facility Selection.* George Washington University, Washington, D.C., June 1962. (DDC No. AD 459-350).

A study was made of the cost aspects of facility selection to improve management understanding and decision-making capability. The subject was the flow of cargo through water ports in the continental United States. The costs and benefits associated with tighter management control are explored and procedures are worked out for use by management technicians.

I100.0400 Dishong, W.R. and Eastman, R.O. *Cost Effectiveness in Communication Systems.* Navy Electronics Laboratory, San Diego, California, October 1965. (DDC No. AD 478-076).

A mathematical model was constructed as the basis for a computer program. Cost was calculated with regard to system performance.

I100.0450 Dole, S.H. and Margolis, M.A. *Sources, Availability, and Estimated Costs of Propellants.* P-1639. The RAND Corporation, Santa Monica, California, March 1959. (DDC No. AD 224-279).

Costs and availability criteria for the selection of propulsion systems and propellants for particular applications and a compilation of propellant availability and costs are presented. System costs are examined in relation to costs of the overall system. The effect of the volume of production on costs is considered, as are the availability of rocket fuels and oxidants and the expansion of their production.

I100.0500 Encimer, J.P. *Price Increase Factors.* Ship Parts Control Center, Mechanicsburg, Pa., November 1963. (DDC No. AD 488-284L).

Whenever a stock list item has not been procured for several years, it is expected that there will be some increase in the new unit price over the old acquisition price, particularly because of the increased labor and material costs to the manufacturer. Then the question arises: what reasonable increase in costs can the U.S. Navy Ships Parts Control Center (SPCC) expect on material that has not been procured for one year; two years; or several years. Two different approaches, one by historical data and the other by the cost index, have yielded approximately the same average increase: 4.6% vs. 4.9%. It seems reasonable, then, to believe that the real increase is approximately 5%. (Author)

I100.0550 Freed, Alvyn M. "Human Interactions in Man-Machine Systems," *Human Factors,* Vol. 4, No. 6 (December 1962), 389-396.

Human interactions play a vital role in the reliability of man-machine systems. Techniques are necessary to insure that those which occur do so because they are now designed and planned. A tentative approach to providing lists of such interactions and ways of defining, labelling and measuring them are suggested as basic to design input. Methods for isolating units of interactive behavior are proposed and samples of system behavior and their respective activities described in terms of actions and reactions. The need for definition and labelling of activities couched in operational terms is emphasized in the interest of design, training and measurement of human interactions in man-machine systems. Techniques for accomplishing these steps are suggested.

I100.0582 Johnston, J. *Statistical Cost Analysis.* New York, McGraw-Hill Book Company, Inc., 1960.

The purpose of this study is to subject certain economic hypotheses about cost/output relationships to empirical testing. These hypotheses are concerned with the variation of production costs within a firm as the level of output changes. Examined are both the short period variation, where certain factors of production are held fixed, and the long period variation, where no factor restraints apply. Six industries were selected for investigation: coal mining, road passenger transportation, food processing, electricity, insurance, and building societies.

I100.0591 Joslin, E.O. and Mullin, M.J., (L.G. Hanscom Field), Proceedings, *Cost-Value Technique for Evaluation of Computer System Proposals,* Joint Computer Conference, Spring 1964, p. 367-381.

This paper describes, and discusses the advantages of, the cost-value technique for computer evaluation, and compares it in particular with the weighted factors selection method. The new technique attempts to make the function of computer selection more meaningful and understandable by eliminating some of the major weaknesses found in most other techniques. There are two major changes in the cost-value technique. Firstly, it attempts to consider all items of value to a computer system, but to consider them only once and in the environment in which they belong. Secondly, the cost-value technique uses dollars rather than weighted points as the basis of comparison.

I100.0623 Moores, B.L. *User's Manual for the Computerized Electronic System Cost Model: 7030 Modifications.* Mitre Corporation, Bedford, Massachusetts, October 1964.

Changes are described which resulted from converting the computer program for the model described in report AD-608057 (Reference 976) from FORTRAN II for the IBM 7090 to FORTRAN IV for the IBM 7030, and from implementing several operational improvements.

I100.0633 Morgan, Donald E. and Ireson, W. Grant. *Quality Cost Analysis Implementation Handbook.* Department of Industrial Engineering, Stanford, California, Stanford University, September 1964.

The QUICO (Quality Improvement through Cost Optimization) system covers the planning, installation, and use of quality cost data analysis. The basic idea is simply to operate a manufacturing unit or complex so that the total of quality related costs is a minimum. Quality related costs are made up of (1) expenses incurred because of not producing the highest possible quality (resulting costs), (2) expenditures made to create conditions resulting in high quality products (quality creation costs) and (3) expenditures made to measure quality levels being produced and causes of deficiencies (quality and defect inference costs). Analysis of quality cost data provides direct pay-offs in reduction of resultant costs and the major sources are discussed. Secondary benefits come from use of the data as a measurement of the effectiveness of the quality assurance effort, as a motivant to workers who must produce the high quality, and as a management guidance tool. Suggested cost accounts are given along with suggested methods of summarizing and displaying data in the most meaningful way for all levels of use. Almost all companies now have sufficient cost data to estimate cost reduction to be expected from the QUICO system.

I100.0650 Logistics Management Institute. *Technical Manual Costs and Effectiveness.* Washington, D.C., November 1962. (DDC No. AD 472-967).

As a primary information resource, technical manuals describe how the equipment, manpower, and support-material should function together as an operating system. The quality and availability of tech-manual inputs critically affect their validity, timeliness, length and costs. Manuscripts should contain the following inputs, preferably in documentary form: (1) design and test decisions; (2) maintenance engineering decisions; (3) material provisioning decisions; (4) personnel decisions.

I100.0700 National Academy of Sciences–National Research Council, Shipboard Mechanization/Manpower Commission. *Shipboard Systems Costs: A Functional Analysis of Work Aboard Ship.* Washington, D.C., October 1966. (DDC No. AD 642-515).

This report is one in a series detailing the results of systems analysis work aboard 20 different merchant ships. It presents information relating to one of these ships. This report also describes a system for the retrieval and analysis of data required for the effective management of a ship.

I100.0750 National Academy of Sciences–National Research Council, Shipboard Mechanization/Manpower Commission. *Shipboard Systems Costs: A Functional Analysis of Work Aboard Ship. The S.S. President Lincoln, A Dry Cargo Ship in the Trans-Pacific Service.* Washington, D.C., October 1966. (DDC No. AD 642-518).

This report is one in a series detailing the results of systems analysis work aboard twenty (20) different merchant ships. It presents information relating to one of these ships. This report also describes a system for the retrieval and analysis of data required for the effective management of a ship.

I100.0800 Rohe, William D., Jr. "Engineering Integration in System Design," *Systems Effectiveness,* U.S. Department of the Navy, Office of Naval Material, Systems Effectiveness Branch, Washington, D.C., 1965.

I100.0850 Salmon, Royes. *A Computer Code (CDC 1604A or IBM 7090) for Calculating the Cost of Shipping Spent Reactor Fuels as a Function of Burnup, Specific Power, Cooling Time, Fuel Consumption, and Other Variables.* Tenn., Oak Ridge National Lab., August 1964.

The calculation of the costs incurred in shipping irradiated uranium-containing fuel elements is discussed. A computer code that designs a cask and calculates the shipping costs is presented. This code, designated MYRA, may be run on either the CDC 1604A or the IBM 7090. By use of the code, shipping costs were calculated for typical reactor fuels. These results are used to illustrate the effect of burnup, specific power, and other variables. The code includes calculation of the length of time required for the accumulation of a reprocessing batch of given size. This takes into account the scheduling and batch sizes of the discharge, shipping, and reprocessing operations. Criticality calculations are not included. It is assumed that criticality can be prevented by using permanent poisons in the metal divider plates between the fuel elements. The code will be useful to those who are concerned with optimal shipping procedures, schedules, and cask designs. (Author)

I100.0900 Shappert, L.B. and Salmon, Royes. *Shipping Cost Comparisons for Lead-, Steel-, and Uranium-Shielded Casks.* AEC No. ORNL-3918.

Tenn., Oak Ridge National Lab., March 1966.

Lead-, steel-, and uranium-shielded casks were compared, based on the total cost of transporting spent fuel from a reactor to a reprocessing site 1,000 miles distant. The unique feature of the comparison was that the costs were compared not on the basis of the same fuel load for each cask, but on the same cask weight. This weight was limited to 25 tons empty weight (or as much as 29 tons loaded), which is about the maximum that can be handled in unrestricted trucktrailer shipments. The total cost, the sum of four separate charges, included handling, freight, insurance, and cask amortization. The results of this comparison indicate that the use of uranium-shielded casks can be economically advantageous, provided that the cost of the cask can be kept in the range of $4.00 to $9.00 per pound of cask weight (empty). The greatest advantage to the reactor operator occurs if he is able to keep the cask in use 100% of the time, or rent a cask when needed. (Author)

I100.0960 Walters, A.A. "Production and Cost Functions: An Econometric Survey," *Econometrica,* Vol. 31, Nos. 1-2 (January-April 1963), 1-66.

This article contains a discussion of short and long run production cost functions. Relationships between quantities of output and costs are examined. The problem of obtaining suitable cost data from engineering or accounting data is considered. The results of a number of studies are examined to determine the shape of long and short run cost curves.

Equipment

I200.0000 Friedland, E.I. *On the Construction of Cost Estimating Relationships.* W-5440. The MITRE Corporation, Bedford, Mass., December 1962.

Examines several methodological questions in developing cost estimating relationships. The derivation of relationships is discussed separately for existing and future equipment. A distinction is also drawn between estimating costs of equipment within the current state of the art and that beyond it. The uncertainty associated with estimating these costs is outlined. The selection of independent variables and the proper level of aggregation are examined. The value and limitations of statistical techniques are discussed as they apply to cost estimating relationships.

I200.0100 Barbour, A.A., Firstman, S.I., and Kamins, M. *Standardization of Automatic Test and Checkout Equipment: A Preliminary Discussion.* RM-2685. The RAND Corporation, Santa Monica, California, 25 November 1960.

This report is intended as a guide in the evaluation of the technical and economic feasibility of standardizing automatic test and checkout equipment. Amounting to a 'think piece', it covers what the authors believe to be the topics pertinent to several levels of standardization. It is not a partisan study, since care has been taken to point out the problems and pitfalls inherent in standardization, and it includes a section devoted to arguments against standardization.

I200.0200 Cooper, Joel, "An Integrated Approach to Systems Maintainability," *Electronic Maintainability,* Vol. 3, ed. F.L. Andenbrandt. New York, Reinhold, 1960.

Since a high percentage of malfunctions are initiated by humans, a method for estimating the 'human reliability' of a system would be useful during the planning and development sequence. It is proposed that classifying maintenance operations and collecting data on time, accuracy, and variability in performing them would be useful. Such data could be applied for example, to the man-machine allocation problem. If human response variability for a set of operations is too great, then that group of tasks becomes a good candidate for mechanization or procedural revision.

I200.0300 deBoer, A.A. "Economic Aspects of the Nuclear Ship Propulsion," *Economisch – Statistische Berichten,* Vol. 46 (1961), 398-400.

I200.0350 Denhard, William G. *Cost Versus Value of Ball Bearings.* Massachusetts Institute of Technology, Instrumentation Laboratory. Cambridge, Massachusetts, July 1966. (DDC No. AD 488-213L).

The paper redefines precision fluid-film ball bearings in terms of current technology. The materials, manufacture, inspection, application, and use of ball bearings capable of four years of use with no wear are evaluated with regards to their increased cost of production.

I200.0400 Drake, John W. and Schein, Robert L. *Comparative Cost Analysis of Microwave and Wire Line Radar Remoting Techniques.* Systems Analysis and Research Corporation, Boston, Massachusetts, March 1963.

The future costs of two electronic systems are compared for the FAA, as are systems derived from mixtures of the elements of both systems. It is concluded that wire line techniques are less costly, but not by enough to override any serious non-cost considerations.

I200.0500 Early, L.B., Barro, S.M. and Margolis, M.A. *Procedures for Estimating Electronic Equipment Costs.* RM-3072-PR. The RAND Corporation, Santa Monica, California, May 1963.

Contains a description of data sources and methods used to develop costs of electronic equipment. Multivariate relationships are required for electronic equipment to a greater extent than for other aerospace products, and such relationships are apt to be valid only within a more limited size and performance range. Several electronic systems are costed as examples.

I200.0600 Fergusson, E. Stuart and Drake, John W. *Techniques and Costs of Radar Remoting.* Systems Analysis and Research Corp., Boston, Mass., July 1962. (DDC No. AD 283-483).

Methods of remoting both primary and secondary radar data (and also secondary only) from sites to centers are considered on the basis of: (1) information content, (2) reliability, and (3) cost. Information content is arbitrarily restricted to messages about aircraft. System considerations other than the site-center link are excluded. Methods discussed are: the present microwave, the present microwave plus radar processing for computerization at the ARTCC and site radar processing and narrow band transmission over telephone lines of machine readable language for computerization at the ARTCC. Each of the three methods is discussed for transmission of beacon information only and for transmission of both radar and beacon information. Reliability is discussed in terms of the effect of major and minor outages, and in terms of drop-outs and noise that cause errors in individual messages. Representative cost estimates are made for the various links on

the basis of existing operations, and where necessary, extrapolation from existing equipment that might be applicable. Average annual costs of the three methods of remoting, by type of system and remoting distance, are calculated. (Author)

I200.0650 Firstman, Sidney I. *How Much Automaticity for Checkout Equipment.* P-1867. The RAND Corp., Santa Monica, California, January 4, 1960.

The author states that the degree of automaticity with which an automatic checkout system operates is determined primarily by the method of programming (or control) employed, i.e., whether, for example, a digital computer or a paper tape control system with manual decision is employed. And since the nature of the programmer determines, to a large extent, the nature of the checkout system (and vice versa), this paper discusses some of the relevant differences between the two generic types of automatic programmers–internally and externally programmed–that should be considered when determining the degree of automaticity to build into an automatic checkout system for any particular application.

I200.0680 Firstman, Sidney I. *Some Limitations of Automatic Test Equipment.* P-2319, The RAND Corp., Santa Monica, California, May 22, 1961.

This article discusses some of the limitations of automatic test equipment (ATE). The limitations are broken into the following four categories: (1) limitations surrounding automatic testing per se; (2) those most clearly associated with ATE-prime equipment interactions; (3) those associated with ATE operating in its environment; and (4) those concerned primarily with man-machine activities.

I200.0700 Firstman, Sidney I., Barbour, A.A., Brom, J.R., Jordan, N., Kamins, N., Meyer, K.H. and Voosen, B.J. *An Omnibus of Briefing Papers on Analysis of Automatic Checkout Equipment and Aids to Its Design.* RM-2750. The RAND Corporation, Santa Monica, California, June 12, 1961.

This memorandum is a summary briefing, together with shorter back-up briefings, on a RAND study of automatic checkout equipment and aids to its design (Project ACE). The material, essentially unchanged, has been gathered in this format to make ACE results available quickly to persons who are concerned with automatic checkout equipment but who have not heard the presentations.

The memorandum opens with a summary of RAND's Project ACE, including a checklist of operational features. This is followed by nine briefing papers on subordinate aspects. Detailed back-up material is cited where appropriate. A bibliography of ACE publications released or in process is provided on p. vii.

I200.0750 Fox, P.D. *Cost/Reliability Research.* Volume I. TRW Space Technology Laboratories, Thompson Ramo Wooldridge, TRW Systems, San Bernardino, California, May 1964.

I200.0770 Franks, P.E. and Furnish, C.W. *Automated Maintenance: Theory, Practice, and Implications for Training.* WADD Technical Report 60-412. Wright Air Development Div., Wright-Patterson AFB, Ohio, August 1960.

The automatic checkout concept may be justified insofar as it (1) reduces skilled manpower needs, or (2) serves to achieve an extremely short operational reaction time. A successful checkout system must be multipurpose, accurate, efficient (in terms of testing time), seldom fail, and have a quick change capability while keeping costs within reasonable limits.

Assuming that ACE will soon be in use and time is short to prepare for its impact, the anticipated effects of ACE on personnel skill levels, motivation, logistics, cost system accuracy, and training are discussed.

I200.0800 Jannsen, T.J. and Glazer, H. *Electronic System Cost Model.* TM-3364. The MITRE Corp., Bedford, Mass., August 8, 1962.

A computer model for costing electronic systems is described which is designed to provide (1) single time-phased estimates of system costs for given configurations and (2) multiple estimates of system costs as selected parameters are varied. The first section of the paper presents a general discussion of the model and its use in system cost analysis. The next section contains a description of the model, including input elements, the cost estimating structure, cost estimating relationships, and output formats. Planned extensions of the model are discussed in the last section. Input data forms, the detailed cost estimating structure, and output format examples are presented in appendices.

I200.0820 Johnston, D.E. and Weir, D.H. *An Assessment of Operational and Cost Trade-off Factors for a Typical High Performance AFCS.* TR-119 1. Systems Technology, Inc., Inglewood, Calif., June 1962. (DDC No. AD 286-327).

Preliminary design evaluation and optimization techniques were applied to an existing operational manned aircraft flight control system (AFCS) to determine: the possibility of improvements in unreliability, maintainability, operability, and initial cost derived, without sacrifice in performance, from an approach which views pilot, controller, and vehicle as components of an integrated whole; and the payoffs realizable by tailoring the controller-airframe-specification combination to take full advantage of pilot capabilities so that a balance is struck between manual and automatic means of accomplishing control functions. The A4D-2N aircraft and its AFCS were studied. The system is broken down to fundamental piece-part levels (e.g., resistor, transformer, actuator, synchro, etc.) and the relative contribution of each piece-part is evaluated. The individual contributions are then grouped by function (e.g., positional servo loop, rate feedback loop, etc.) and by control axis to determine the over-all cost of the function and its relative contribution to the total system cost. A summary is presented of the preceding assessments in the form of generic tradeoff plots of cost versus system complexity.

I200.0840 Jones, M.V. *A Generalized Cost Structure for Electronic Systems.* TM-3299. The MITRE Corp., Bedford, Mass., May 1962.

This paper presents a generalized structure for cost analysis in electronic systems. The structure serves as (1) a framework for organizing cost estimating data, (2) a display format to exhibit comparisons of costs of diverse electronic systems, and (3) a checklist from which to develop special cost structures for particular system cost studies. Each of the cost elements is defined and the conceptual problems of developing a cost structure are discussed.

I200.0900 Kececioglu, Dimitri and Hughes, Roy C. *Design of Equipment to Optimize Reliability for Manufacturer's and Customer's Minimum Total*

Cost. Allis (Louis) Co., Milwaukee, Wis., February 1963. (DDC No. AD 400-281).

I200.0929 Madris, S.J., Andersen, Arthur and Company. *Methods and Meaning of Comparing EDP Equipment Characteristics and Costs.* Retail Research Institute Electronic Data Processing Up-Dating Service, March 15, 1966.

Announcement of new computers and major modifications to old ones arrive at an increasing rate. This is making the job of studying, comparing and evaluating new equipment a more difficult task. A disciplined approach to hardware comparison is a necessity: the following reasons for this are: there is a broad range of computer hardware that performs a given job; these computers are available in a broad price range; and the user is now more sophisticated due to years of experience.

An approach to an EDP equipment evaluation can be developed by including these work steps: decide on potential vendors and computers based on preliminary systems designs and cost analyses; prepare specifications and solicit proposals; establish and weigh selection criteria; review proposals and conform to basic system, and evaluate selection criteria by means of rating system. A detailed discussion of each of these work steps is included.

I200.0950 Manowitz, B., Kuhl, O., Oltman, A., Kukacka, L.E. and Steinberg, M. *Cobalt-60 Research Irradiators.* AEC No. BNL-8976. Upton, New York, Brookhaven National Lab., September 17, 1964.

Four pool-type gamma irradiation units and one portable lead-shielded irradiator have been designed and built. Figures on construction, operating, and maintenance costs are given. (Author)

I200.1000 Sargent and Lundy. *Large Turbine Performance and Turbine Plant Cost Study.* SL-2317. Tenn., Oak Ridge National Lab., December 1, 1965.

Performance data and cost estimates are developed for units employing large condensing and noncondensing turbine generators applicable to large nuclear dual-purpose power and desalination plants. The units studied have capacities ranging from 300 to 750 MW(e) and a variety of steam conditions and cycle arrangements. (H.D.R.)

I200.1100 Scarfile, A., Dagen, H., Tobin, R. and Thomas, E. *Cost-Effectiveness Evaluation Procedures for Shipboard Electronic Equipment and Systems, Volume I, Development and Trial Application of Procedures.* Arinc Research Corporation, Annapolis, Maryland, February 1966. (DDC No. AD 803-985L).

A generalized model was developed to permit the realistic determination of cost-of-ownership and certain effectiveness values for shipboard electronic equipment. It was concluded that the cost and effectiveness evaluation procedures developed in the program were practical and effective for the six shipboard electronic equipments on which they were tested, and they are at once sufficiently detailed and general for application to other shipboard electronic equipments.

I200.1150 Scarfile, A., Dagen, H., Tobin R. and Thomas, E. *Cost-Effectiveness Evaluation Procedures for Shipboard Electronic Equipment and Systems, Volume II, Detailed Procedures and Instructions.* Arinc Research Corporation, Annapolis, Maryland, February 1966. (DDC No. AD 803-986L).

This volume sets forth in detail the procedures developed for determining cost-of-ownership and effectiveness values and applying them to shipboard electronic equipments. Volume 2 consists of four parts: (1) collection and reduction of input data; (2) computer program description and operating instructions; (3) analysis and interpretation of computer program outputs; and (4) procedure for developing a capability for cost-effectiveness analysis.

I200.1200 Sharkey, E.H. *The Advantages of Functional Packaging of Electronics Equipment.* P-1629. The RAND Corp., Santa Monica, Calif., March 5, 1959.

The discussion here is concerned primarily with how packaging methods can materially affect the out-of-commission time of the aircraft, and the cost and difficulties of line maintenance.

The methods that the line maintenance people must use are largely dictated by the decisions made by the packaging engineer in the original equipment design.

I200.1250 Stein, P.E., Ayers, A.C., Braatz, R.J., Bradford, C.M., Holt, V.D. and Mattie, G.P. *The Influence of Design and Production Parameters on Fabrication Costs of Nuclear Reactor Fuel Elements.* AEC No. Y-1368. Tenn., Oak Ridge National Lab., September 28, 1961.

A study was conducted to determine fuel fabrication and assembly costs in a large nuclear power industry for several reactors, fuel rod sizes and fuel materials. The bases and assumptions for development of cost data are discussed along with methods for developing cost equations. Results and interpretations are included. (J.R.D.)

I200.1300 Steinberg, Meyer and Green, Leon. *Economics of Fission Neutron and Gamma Chemo-Nuclear Reactors for Production of Ethylene Glycol and Phenol.* AEC No. BNL-5755. Upton, New York, Brookhaven National Lab., October 1960.

Design and economics of a neutron-gamma radiation processing reactor for the production of ethylene glycol and phenol are discussed. The technical problems to be solved in liquid phase processing by fission neutron-gamma reactors are outlined. Ethylene glycol can be produced from methanol by fission neutron-gamma and fission recoil radiations in an endothermic reaction. Phenol can be produced from benzene in an aqueous liquid phase partial oxidation process using gamma radiation in an exothermic reaction. It was concluded that fission neutron and gamma chemonuclear reactors for low G value reactions require unreasonably large reactor capacities for tonnage chemical production. Even for the higher G value phenol process estimated costs were still higher than present conventional costs. (M.C.G.)

Equipment — Learning Curve

I210.0100 Baloff, N. "The Learning Curve: Some Controversial Issues," *The Journal of Industrial Economics,* Vol. 14 (1965-1966), 275-282.

A wider application of the learning curve is discussed. Hindrances to its wider application are found to be a narrow understanding of the productivity phenomenon, uncertainty with respect to the actual form of the model,

a lack of communication of past empirical results. The role of indirect labor in productivity is discussed, as are practices including the use of the constant parameter value and the interminable progress assumption.

I210.0150 Brewer, Glenn M. *The Learning Curve in the Airframe Industry.* Air Force Institute of Technology, Wright-Patterson AFB, Ohio, August 1965.

This paper presents a description of the mathematical properties, development and uses of the learning curve in the airframe industry. A discussion of learning curve literature and a bibliography are included, as is a discussion of the validity and reliability of learning curves. Mathematical techniques, including correlation and regression analysis for constructing curves, are presented.

I210.0200 Bryk, Oliver. *Models in Cost-Effectiveness Analysis: An Example.* Research Analysis Corp., McLean, Virginia, June 1965. (DDC No. AD 622-109).

Describes a set of models designed for a cost-effectiveness analysis of alternate aircraft systems.

I210.0250 Eliel, L.F. *Compound Progress Curves–An Approximation to Multi-Element Learning Curves.* Aerospace Corporation, Los Angeles, California, April 1962.

The construction and nature of the multi-element cost curve are described. This curve is described as a more realistic model of total cost per unit than the conventional linear learning curve. The compound curve, which is convex on log paper, is readily integrable. A normalized approach to cost simulation is presented, together with the resulting parameter values of the compound progress curves. Data reduction procedures for minimum information are discussed, and possible uses of the compound progress curve theory are indicated.

I210.0300 Fredric, Brad. *Learning Curve Analysis.* TEMPO SP-197. General Electric Company, Santa Barbara, California, October 1962.

Presents data for comparing the total cost consequences of alternative slope and production quantity combinations. Data are presented for calculating differences in total cost as the learning slope is varied; differences in total cost for varying production quantities; in assuming a constant slope and for differences in both slope and production quantities. A total cost nomograph is also included for deriving cost values.

I210.0350 Hirschmann, W.B. "Profits from the Learning Curve," *Harvard Business Review,* Vol. 42, No. 1 (January-February 1964), 125-139.

Contains a discussion of the nature and use of the learning curve. The effects of assembly and machine work on the slope of the curve are explained. It is pointed out that the learning curve has not been generally adopted outside the aircraft industry. An application of the learning curve to petroleum refining is examined, and the shorter time required for start-up operations through repetition is described as an example of learning in a labor-intensive refinery operation. The maintenance learning curve is also considered, and improvement through learning in the construction of refineries is examined.

I210.0400 Novick, D. *Use of the Learning Curve.* P-267. The RAND Corporation, Santa Monica, Calif., November 1951. (DDC No. AD 422816).

Contains a discussion of the constituents of the learning curve–direct labor and materials. The learning curve is described as applicable only to the direct labor element of cost in the facility producing the finished item. Although purchased items are subject to the improvement curve, it may be misleading to aggregate both direct labor and purchased parts and apply the uniform learning curve. A table is included showing the average percentage reduction for successive numbers of units for an 80 percent learning curve. It is also pointed out that learning carried over from related production must be placed at the proper position on the curve.

I210.0450 Raborg, W.A., Jr. "Mechanics of the Learning Curve," *Aero Digest,* Vol. 65, No. 5 (November 1952), 17-21.

This article consists of a description of the learning curve and its construction. The use of the learning curve expanded rapidly with the expansion of the aviation industry. The learning curve is described as a graphed line showing (1) that time required to do a job will decrease with repetition and (2) the amount of decrease will be less with each successive unit. The graphical construction of the curve is done in three parts: (1) the cumulative average line, (2) the cumulative total line, and (3) the unit time line.

I210.0500 Young, S.L. "Misapplications of the Learning Curve Concept," *The Journal of Industrial Engineering,* (August 1966), 410-415.

The purpose of this article is to examine the various factors in addition to learning that are involved in the learning curve. Governmental contracting methods are discussed as a contributing factor in contractors' cost performance. Production time budgeting is likewise identified as providing for unit cost reduction. Reclassification of labor from direct to indirect is also identified as a contributor to the reduction. The view is presented that management action, as opposed to repetition, is responsible for the appearance of unit cost reduction.

AIRCRAFT PRODUCTION

I300.0100 Alchian, A. *Reliability of Progress Curves in Airframe Production.* RM-260-1-PR. The RAND Corp., Santa Monica, Calif., February 1950. (DDC No. ATI 210621).

This memorandum contains an assessment of the reliability of cost predictions made on the basis of airframe cost/quantity curves. The functions are shown to differ in direct labor per pound of airframe among the various types and the different manufacturing facilities. The average error in prediction is described and measured. If curves for specific manufacturing facilities are used, the margin of error in prediction is reduced.

I300.0120 Andrianov, D.P., Gendel'man, M.Z., Glichev, A.V., Didenko, S.I. and Zhuravlev, A.N. *Management, Planning, and Economics of Aircraft Production.* Rough draft translation of 1963 paper. Foreign Technical Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, December 1964. (DDC No. AD 609-900).

This book was written as a text for aviation schools of higher education. It presents an integrated analysis of problems related to the economics of the aircraft industry.

1300.0140 Arrow, K.J. and Arrow, S. *Methodological Problems in Airframe Cost-Performance Studies.* RM-456-PR. The RAND Corporation, Santa Monica, California, September 1950. (DDC No. AD 116-556).

This study examines the problem of defining the relationship between cost and performance in aircraft. Cost is treated as a function of both the technical and performance characteristics of the aircraft. Material and labor costs are discussed together with cost reduction through learning.

1300.0160 Arrow, K.J., Arrow, S. and Bradley, H. *Cost-Quality Relations in Bomber Airframes.* RM-536-PR. The RAND Corporation, Santa Monica, California, February 1951. (DDC No. ATI 210678).

Describes a method for predicting how changes in bomber performance affect production costs. Production cost is expressed in man-hours. The learning curve concept is employed in the formulas presented for cost prediction.

1300.0180 Asher, Harold. *Cost-Quantity Relationships in the Airframe Industry.* R-291. The RAND Corporation, Santa Monica, California, July 1956. (DDC No. AD 105-540).

A comprehensive examination is made of the relationship between costs and quantities in the production of airframes. The available literature is discussed, as is the theory of progress curves. The elements of airframe costs are examined in detail. Empirical data and graphs are used to demonstrate cost-quantity relationships for past production. The conventional progress curve, which is linear on logarithmic grids, is found to be inaccurate for the relationship between cost and cumulative output. For certain values of cumulative output labor and production curves become convex.

1300.0200 Barro, Stephen M. *Some Methodological Problems of Airframe Cost Estimation.* P-3305. The RAND Corporation, Santa Monica, California, March 1966.

Compares three studies that were conducted for the purpose of developing estimating methods for aircraft costs. Some differences in objectives among the studies are pointed out.

1300.0220 Campbell, H.G. "Missile Airframe Cost Estimating Techniques," in *Concepts and Procedures of Cost Analysis.* RM-3589-PR. The RAND Corp., Santa Monica, California, June 1963. (DDC No. AD 411-554).

Ratios of cost to propellant weight are described as the basis for estimating labor hours per pound of airframe. Costs per pound are calculated for components.

1300.0240 Carrier, J.M. and Smith, R.W. *Aircraft Airframe Cost-Estimating Techniques.* RM-3375-PR. The RAND Corporation, Santa Monica, California, November 1962. (DDC No. AD 293-863).

Presents an introduction to estimating techniques used in costing airframes. The production inputs are discussed and a procedure is presented for estimating both recurring and non-recurring costs. The procedure consists of a series of steps in developing cost estimates. The prediction of cost as a function of several variables in airframe characteristics is considered. An example is also provided.

1300.0260 Dienemann, P.F. and Sumner, G.C. *Estimating Aircraft Base Maintenance Personnel.* RM-4748-PR. The RAND Corporation, Santa Monica, California, October 1965.

Contains a discussion of methods for estimating aircraft base maintenance personnel requirements. Such personnel are divided into three categories: direct maintenance, maintenance overhead, and other maintenance. A series of relationships is developed for the first category for advanced aircraft to estimate personnel requirements on the basis of design and performance characteristics. Requirements for maintenance overhead are derived from these estimates. Techniques using current USAF manning procedures are described to estimate all other maintenance personnel.

1300.0280 Erickson, H.G. *An Empirical Method for Estimating the Cost of an Aircraft.* Ling-Temco-Vought, Inc., Dallas, Texas, May 1962.

Describes methods for estimating aircraft costs without the prior preparation of detailed work statements. Mathematical relationships are presented for deriving total contractor program costs for aircraft ranging from a Mach .6 propellor configuration to Mach 2+ jet powered airplanes. Eight variables associated with the design and construction of the aircraft are used for estimating costs. Charts are included in plotting costs for the aircraft structure and for related equipment.

1300.0300 Fowlkes, T.F. *Aircraft Cost Curves.* General Dynamics, Fort Worth, Texas, August 1963.

Provides a general study of cost curves, covering their origins and development. The characteristics of cost curves are discussed together with their use in projecting and establishing costs. Examples are presented of calculations for unit costs and cumulative total manufacturing hours for a number of percentage cost curves. Tables and graphs are included for the projection and analysis of costs.

1300.0320 Hohenemser, Kurt H. "The Supersonic Transport," *Scientist and Citizen,* Vol. 8 (April 1966), 1-10.

Discusses some of the unanswered questions relevant to a cost-benefit analysis of the proposed supersonic transport plane.

1300.0340 Leach, R. *Development of a Price Index for Aircraft and Missile Manufacturing.* Technical Memorandum 330. Defense Research Corporation, Santa Barbara, California, March 1966.

This report contains a price index for aircraft and missile manufacturing. The method used in developing the index is described. The purpose of the index is to provide a means for adjusting dollar price data. Items chosen for the composition of the index represent an approximation of the activities and materials involved in the manufacture of aircraft and missiles. The index spans the years from 1954 through 1964, and consists of four elements, as follows: (1) non-production labor, (2) production labor, (3) metals and metal products, and (4) electrical equipment.

1300.0360 Kornfeld, J.P. *Cost-Effectiveness as a Method of Evaluating Design Changes.* Boeing Airplane Company, Aero-Space Division, Seattle, Washington, 1960.

1300.0380 Margolis, Milton A. *The Use of Cost-Estimating Relationships in the Air-Frame Industry.*

P-3472. The RAND Corporation, Santa Monica, California, October 1966.

Discusses the use of statistically derived cost-performance and cost-design relationships to project new flight vehicle costs. The extent and frequency that estimating relationships are used by airframe manufacturers are discussed together with the reasons for their wide use and the degree of uniformity in their use. Airframe estimators are decribed as preferring in most cases the use of statistical rather than industrial engineering estimates, and primarily for two reasons: (1) they are less expensive and (2) they are more accurate.

I300.0400 Planning Research Corporation. *Methods of Estimating Fixed-Wing Airframe Costs.* PRC-547. Los Angeles, California, February 1965.

Describes the development of equations for estimating the production costs of airframes for new fixed-wing aircraft. Cost data on post World War II military aircraft were collected and analyzed. Costs were divided into four major elements (manufacturing labor, manufacturing materials, engineering, and tooling), and the costs for each element were developed at four production points (units 10, 30, 100, and 300). Sixteen cost-estimating equations were then derived, one for each of the four elements of cost at each of the four production points. Procedure for using the equations and methods for computing standard deviations and prediction intervals for the cost estimates are also presented.

I300.0420 Watts, Frank A. *Aircraft Turbine Engines–Development and Procurement Cost.* RM-4670-PR. The RAND Corp., Santa Monica, Calif., (Abridged), November 1965. (DDC No. AD 363904).

The results of this study are based on the history of 14 engines representing expenditures of approximately $8 billion. Satisfactory multiple regression equations were derived for turbojets and turboprops relating cost to engine size and quantity. A discussion is included of the institutional and environmental influences on cost. Such influences include the relative capability of the contractor, the urgency of the program, the number of changes, the amount of funds known to be available, and the contractor's level of current business. The study is intended primarily for use in long-range planning exercises on manned military aircraft.

I300.0440 Wingert, R. *LFC Airplane Operational and Cost Analysis.* Final Report. Norair Div. Northrop Corp., Hawthorne, Calif., April 1964. (DDC No. AD 601-735).

This report presents operational, maintenance, and cost analysis of transport/cargo class aircraft equipped with laminal flow control for reduced drag based on analytical studies and results of the X-21A results were used to the maximum extent possible in these analyses. However, technical problems involving the fabrication of LFC surfaces to the required waviness tolerance and a leading edge-flow instability phenomenon which developed during this program served to limit the scope of scheduled tests, particularly those relating to operational and maintenance requirements of LFC systems. For this reason, the operational and maintenance analyses are supplemented with results of analytical studies and wind tunnel or laboratory tests. Further testing with the X-21A airplanes has been proposed to resolve these technical problems, and to demonstrate operational suitability and maintainability of the LFC system in environments normally encountered by service-type aircraft.

I300.0460 Wright, T.P. "Factors Affecting the Cost of Airplanes," *Journal of Aeronautical Sciences,* Vol. 3, No. 4 (February 1936), 122-128.

Presents a discussion of the effect of quantity production on cost. The type of airplane construction is described as a factor governing the cost and shape of the progress curve. The factors that make cost reductions possible with increases in the quantity produced are discussed. Labor improvement is considered, together with increased efficiency in the use of materials. Overhead costs are also discussed in relation to quantity production.

I300.0480 Yates, E.H. *Cost Analysis as an Aid to Aircraft Design* IMR-133. Defense Research Corp., Santa Barbara, California, November 1964.

Contains a presentation made at an AIAA meeting and the written paper on the subject. Cost analysis for purposes of aircraft design is described as necessary for evaluating how performance variations affect cost, for determining preferred characteristics, and for comparing the aircraft with competing systems. The elements of aircraft cost are examined, including airframe, propulsion and other government furnished aeronautical equipment. Cost-estimating relationships are presented for these elements. A series of tables are included containing data on man-hour requirements, cost indexes, materials costs, learning curves, engine cost equations and GFAE cost equations.

I300.0500 Yates, E.H. *A Method for Estimating the Procurement Cost of Aircraft.* RM-60-TMP-39. Vol. 1, General Electric Company, Santa Barbara, Calif., Technical Military Planning Operation (TEMPO), June 1960.

This report contains equations for estimating aircraft costs. The statistical approach is employed with costs presented in functional form. Cost is described as the function of various aircraft physical and performance characteristics. This approach permits cost analysis in support of decisions on system design. The elements of aircraft costs are discussed individually, including: (1) airframe direct labor, materials, overhead, evaluation of learning curve, engineering and tooling, G&A, ECP, and profit, (2) propulsion, and (3) other GFAE. A computational example of the use of the techniques and data is included.

NUCLEAR POWER

I400.0120 Baron, S. "Is Nuclear Power Competitive?" *Electric World,* Vol. 159. No. 13, (April 1, 1963), 24-26.

A treatment is presented of the probable coal and nuclear fuel costs in the future. The mining and transportation components of coal costs and their probable future behavior are considered. The principal factors making up nuclear fuel costs are also discussed in detail: fabrication, reprocessing, use charges, transportation and plutonium credit. A table of forecast nuclear costs for the years 1962 to 1990 is presented with both pessimistic and optimistic values, and the costs are compared graphically with forecast coal costs. (D.L.C.)

I400.0140 Bauer, Walter. "Methodology of Cost Calculations in Nuclear Power Stations (Part I)," *Atomwirtschaft,* Vol. 6 (Nov. 1961), 530-6.

A general cost equation for all reactor types is worked out which makes possible an exact calculation of energy costs and further, provides a basis for operational arrangements in nuclear power stations. It takes into consideration equally economic, technical, and nuclear-physical points of view since only a total study of a projected

reactor construction and of possible technical and cost-wise improvements during operation gives a picture of the profitableness of the installation. (Author)

I400.0160 Beller, Morris and Steinberg, Meyer. *Estimation of Chemonuclear Production Costs.* AEC No. BNL-50006. Upton, N.Y., Brookhaven National Lab., August 1966.

The economic study was conducted to determine whether it is reasonable to assume fissiochemonuclear processes will hold costs down. As the supply of natural fossil fuels decreases, the cost of production of materials based on these fuels will increase. The analysis shows that chemonuclear processes may be capable of producing large quantities of utility and industrial chemicals at costs which are not significantly higher than at present. (J.C.W.)

I400.0180 Bost, William E. *Economics of Nuclear Power.* AEC No. TID-3089. Office of Technical Information Extension, AEC, Oak Ridge National Lab., Tenn., January 1960.

Included are 518 selected references to unclassified reports and published literature on the economics of nuclear power. Author, report number and subject indexes are given. (Author)

I400.0200 Crowleg, J.H. "Economic and Technical Factors Relating Current Water-Reactor Types to Advanced Concepts," *American Nuclear Society,* Vol. 9 (June 1966), 213.

I400.0220 Farbmann, G.H. and Kilpatrick, J.N. "Closed Cycle Water Reactors – The Proven Approach to Economic Nuclear Power," *Atompraxis,* Vol. 9 (August 1963), 322-7.

The major operating and economic advantages of closed-cycle water reactors are described. They are based on proven reliability, complete safety of operation, low power production costs, and competitiveness with fossil fuel plants. (Author)

I400.0240 Fenech, Henri, Richardson, Max C. and Benedict, Manson. *The Effects of Changing Economic Conditions on Fuel Cycle Costs in Pressurized Water Reactor.* AEC No. MITNE-28. Massachusetts, Massachusetts Inst. of Tech., Cambridge, February 1, 1963.

The effects of changing economic conditions on fuel cycle costs in an advanced pressurized-water power reactor with free-standing stainless steel or Zircaloy fuel cladding are analyzed for eight different cost bases. These cost bases represent the effect of most of the combinations of economic conditions likely to occur during the life of the 461 Mw(e) reactor. The cost bases are dependent on the following economic parameters: cost of natural uranium hexafluoride, weight fraction of uranium-235 in uranium hexafluoride of zero value, cost of separative work, fabrication cost of stainless steel and Zircaloy-4 fuels, $Pu(NO_3)_4$ to plutonium cost, plutonium credit, uranium hexafluoride carrying charge excluding time of fabrication, uranium hexafluoride carrying charge during time of fabrication, carrying charge on fabrication cost, and uranium hexafluoride ioss during fabrication of stainless steel and Zircaloy-4 fuels. Three methods of fueling are also considered: batch, and three-or five-zone 'outing.' (N.W.R.)

I400.0260 Geller, L., Hogerton, J., Leerburger, F.J. and Stoller, S.M. *The Effect of AEC Site Selection Practice on Power Transmission Costs and the Potential Nuclear Market.* AEC No. NYO-10280. New York, Stoller, S.M. Associates, March 26, 1963.

Thirty-five electric utilities in high-cost fuel areas were asked to look at their generating stations now in operation, or to be placed in operation within the decade 1958-1967, and to determine whether they meet certain nuclear siting requirements. For those stations not meeting these requirements, they were asked to select alternate station sites and to estimate the differential power transmission costs arising therefrom. Using the information so developed as well as company projected unit additions for the years 1967-1969 and a set of assumed generating costs, it is concluded that: the nuclear site requirements specified are met by very few existing or planned stations sites, alternate site differential transmission costs vary quite widely; and the short term market for nuclear power will probably be somewhat reduced by nuclear site considerations; the long-term market for nuclear power could be seriously restricted if the site requirements used in the survey had to be met. (Author)

I400.0280 George G. Sharp, Inc. *Economic Study of Nuclear Propulsion for American Flag Tankers.* AEC No. TID-14557. George G. Sharp, Inc., New York and Combustion Engineering, Inc., Nuclear Div., Windsor, Conn., November 1961.

A study was conducted to compare the capital and operating costs of tanker designs with nuclear and conventional propulsion for each design. The nuclear plants selected for the study are advanced designs of the pressurized water type. It is concluded that nuclear power for such vessels is approaching a competitive position with conventional power on long routes. Nuclear power also becomes more competitive as ship deadweight increases and as the price of oil increases. (J.R.D.)

I400.0300 Hammond, R. Philip. *Conversion Using Nuclear Energy.* AEC No. CONF-14-6. Tenn., Oak Ridge National Lab., 1963.

The economics of desalting processes for sea water using large nuclear reactors as a source of power for water distilling plants is discussed. It is pointed out that low-cost electric power could be obtained as a by-product in such plants. It is suggested that a 3500 Mev pilot plant of the natural uranium type could be undertaken in a relatively short time and would produce water in the cost range under 20 cents/1000 gal and power for 3 mills/kwhr or less, after writing off development costs. It is also suggested that breeder reactors would ultimately produce the lowest cost energy, but would need a longer time for development. Cost estimates are presented using regenerative evaporation in multi-effect or flash type evaporators and natural uranium reactor or an advanced fast breeder reactor. The cost of water would be 9.8 cents/1000 gal or 6.1 cents/1000 gal, depending on the reactor type used. (C.H.)

I400.0320 Heagerty, J.J., Marsh, W.D. and Anderson, R.K. *Current Nuclear Power Economics.* CONF-660108-1. Preprint No. 31. San Jose, Calif., General Electric Co.; New York, Inst. of Electrical and Electronics Engineers, 1966.

Two new perspectives in evaluating nuclear power economics with respect to capacity and economics are applied to some questions relating to the application of nuclear power to existing electric systems. Some questions investigated are: 1. How does fossil plant investment cost influence the economic application of nuclear power? 2. What is the effect of fossil fuel price on the competitive position of nuclear power? 3. What are the effects of peaking generation on nuclear power economics? 4. What is the effect of system load factor? (B.L.M.)

I400.0340 Heestand, J. and Wos, L.T. *Cost Function Studies for Power Reactors.* Illinois, AEC No. ANL-6442. Argonne National Lab., November 1961.

A function to evaluate the cost of electricity produced by a nuclear power reactor was developed. The basic equation, revenue-capital charges and profit and operating expenses, was expanded in terms of various cost parameters multi-region nuclear reactors with uranium and/or plutonium for fuel. A corresponding IBM 704 computer program, which will compute either the price of electricity or the value of plutonium, is presented in detail. (Author)

I400.0380 Hoffman, Robert B. *Economic Comparison of Fuel Fabrication Processes Used in the High Power Density Program.* AEC No. GEAP-4294. Calif., Atomic Power Equipment Dept., San Jose, June 25, 1963.

The principal objectives of the Consumers High Power Density (HPD) Fuel Development Program are to demonstrate the performance of uranium dioxide and stainless steel clad fuel, at high power density conditions and to explore processes leading to reductions in fuel fabrication costs. The latter objective is discussed and economic comparisons are made of the different processes used in fabricating fuel rods for the Consumers HPD program at APED. The fabrication costs of processes actually used in producing fuel rods are evaluated and compared economically. These processes include pelletized fuel with pellet-to-clad gap (4 to 9 mil) and with gap reduced by swaging, and compacted powder fuel made by cold swaging, hot swaging, tandem rolling, and vibratory compaction. Time measurements of the labor involved in the different processes were made for the 2 and 3-pass, cold swaged powder process, and the reduced gap (swaged) pellet process using both ground and unground pellets. Many of the fabrication steps are common to all of the processes and the labor requirements are the same. In determining the cost of a process which contained one or more unmeasured steps, an estimate of the labor required was made based on fabrication experience in the laboratory. These types of estimates were made in the cases of the tandem rolling operation, the heating operation for hot swaging, and the rod filling operation for vibratory compaction. The results of the fabrication cost analysis for the various processes indicated that the tandem rolling process required the least amount of fabrication labor, followed by the swaged powder, vibratory compaction, and swaged pellet fuel processes, which were the most expensive. Tables are given of the various fuel fabrication processes and their relative fabrication labor requirements. (Author)

I400.0400 I.A.E.A. *Introduction to the Methods of Estimating Nuclear Power Generating Costs.* AEC No. STI/Doc/10/5. Vienna, International Atomic Energy Agency, 1961.

A full list of the cost items likely to be encountered in the design, construction, and operation of a nuclear power plant is presented. The three categories of nuclear power, costs, plant construction, fuel and operation and maintenance are discussed in detail. Current methods of generating cost calculations are outlined and the limitation to which they may be subject discussed. (M.C.G.)

I400.0420 I.A.E.A. *Nuclear Power Economics.* STI/PUB/21/13. Vienna, International Atomic Energy Agency, December 1964.

A total of 771 references, almost all with abstracts, is given to the literature published and/or abstracted during the period 1960-1963. The references are arranged into six sections dealing with general aspects, evaluation of power reactors, nuclear propulsion, water desalination, reactor materials, and other economic aspects. An author index is included. (S.L.C.)

I400.0440 Jackson and Moreland, Inc., Boston, and Allis-Chalmers Mfg. Co., Milwaukee. *Euratom Reactor Fuel Management Program. Part III. Fuel Cycle Analysis.* AEC No. EURAC-803 (Pt. III) (NYO-9922). January 1963.

A nuclear fuel-cycle parametric study is made with the objective of economic optimization of overall unit power costs for the reference-design (Senn) reactor. The assumptions and ground rules used in this study are outlined. Charges incurred before, during, and after irradiation are considered, and fuel cycle unit energy costs are calculated. Recommendations are made for future work in fuel cycle cost analysis. (D.L.C.)

I400.0460 Johnson, C.M. and Marsh, W.D. *Economic Use of Nuclear Power in Expanding Utility Systems.* AEC No. CONF 66-098-10. Chicago, American Power Conference 28th Annual Meeting, n.d.

I400.0580 Kukacka, L.E. and Manowitz, B. "Estimating Gamma-Radiation Processing Costs," *Nucleonics,* Vol. 23, No. 1 (January 1965), 74-78.

I400.0600 Kupp, R.W., Stoller, S.M. and Sengstaken, D.J. "Nuclear Power Economics: A Method of System Analysis," *American Nuclear Society Transactions,* Vol. 6 (Nov. 1963), 325-326.

I400.0620 Lane, J.A. *Optimum Utilization of Nuclear Fuels.* AEC No. ORNL-P-2535. Tenn., Oak Ridge National Lab., 1964.

Data are given on the growth of the U.S. nuclear power industry. On the basis of revised projections, installed nuclear capacity of the United States may reach 66,000 MWe by 1975, and 120,000 to 150,000 MWe by 1980. At present, light water reactors constitute the bulk of sales. These reactors are dependent upon low-cost U and low-cost ^{235}U separation capability of government-owned diffusion plants. Continued construction of inefficient light water reactors may lead to exhaustion of low cost resources, although these reserves may be increased to some extent by exploration. However, rising ore costs will influence power costs by increasing fuel inventory and fuel consumption costs, and it is estimated that fuel requirements for pressurized and boiling reactors, at present expansion rates, will exhaust all reserves costing less than $30.00 per pound by the year 2000. Because capacity of existing ^{235}U enrichment plants is limited, new diffusion plants must be built, but it is also essential that advanced reactors and fast breeders soon become commercially available if nuclear power is to remain competitive. (P.G.C.)

I400.0640 Lemanski, E.J. *Economic Factors of MFP Thermoelectric Generators.* NYO-10462. Newark, N.J., General Instrument Corp., May 1963.

Economic aspects of power generation from underwater thermoelectric generators fueled with Mixed Fission Products (MFP) are given. Costs are estimated to be less than $0.15 per thermal watt for two year old MFP. Studies are on a conceptual design of a unit capable of withstanding pressures equivalent to 18,000 feet submergence on the ocean bottom and 300 year containment of the nuclear heat source. Low cost biological shields of both high density concrete and cast iron were considered. Studies establish the possibility of power costs as low as $10 per watt-year in the kilowatt size, to $100 per watt-year in

the 10 watt range. A comparison of the MFP generator with an equivalent SNAP-7 strontium-90 type indicates that the MFP power costs are far below those for separated radioisotope power, primarily because the highest cost item in the SNAP unit is the purified strontium-90 fuel. A one kilowatt MFP unit would weigh in the order of 20 to 30 tons maximum depending on fuel energy density, and have a diameter of 6 to 10 feet. Optimization studies were made for such factors as fuel geometry, fuel age, energy density, and insulation thickness to determine the most productive areas of reducing the original cost and overall weight estimates. (Author)

I400.0660 Lenderman, L.S. *Costing and Pricing Policies and Practices for Research Materials.* AEC No. ORNL-TM-1047. Washington, D.C., Atomic Energy Commission, n.d.

General costing and pricing practices in the AEC for research materials are given. The costing principles and procedures are based on direct material costs, processing and other costs, reactor operating costs, contractors' overhead costs, and non-fund costs, such as net fuel costs and depreciation. The pricing policy provides that materials and services furnished to others shall be priced at the higher of full cost recovery or current commercial prices so long as these prices will not discourage the use of such materials and services or the development of sources of supply of the materials or services, and will not discourage research and development. (P.C.H.)

I400.0680 Lewis, W.B. *How Much of the Rocks and the Ocean for Power? Exploiting the Uranium-Thorium Fission Cycle.* AEC No. DM-72, AECL-1916. Chalk River, Ontario, Atomic Energy of Canada, Ltd., April 1964.

When rich uranium ores become scarce, the price will rise from $13/kg U, but with improved techniques of extraction and the choice of an economical fuel cycle, abundant uranium for many centuries appears to be available in the rocks and the oceans. Even from reactors already developed to the stage of engineering design it is possible to choose a fuel cycle to which uranium at $250/kg U would contribute no more than 2 mill/kwh. Without suggesting when such a high cost might be reached, its implications are examined. The optimum fuel cycle would balance the financing charges on the fuel inventory and the costs of fuel make-up supply and reprocessing. By using uranium and thorium in combination it was calculated that at least 50,000 Mwd can be derived per ton of uranium. At a net conversion efficiency of 30% and an overall rating of 6 thermal kw/kg, the natural uranium inventory would cost at the suggested high price $250/ (6 x 0.3) = $139/ekw and for 7000 hr/yr at 7% annual charges would contribute 1.4 mill/ekwh. At 50 Mwd/kg U the make-up supply contributes 250/ (50 x 24 x 0.3) = 0.7 mill/ekwh. Probably higher efficiency and possibly higher specific power ratings would be used to lower such costs. The value of uranium is related to its content of the fissile ^{235}U, and even though most power may be derived from thorium, it was concluded that its value will not rise comparably with that of uranium. The total cost of nuclear power also includes contributions from the cost of equipment and plant operation as well as from costs of fabricating and processing materials. Any other technique or fuel cycle is considered unable to supplant the thermal fission reactors merely by showing a lower demand for fissile material, but if plant and operating costs are not excessive, may enter the competition or become a valuable supplement. Three such techniques recognized are: fast neutron breeders, neutron production by the excitation of heavy nuclei to high energies, and controlled thermonuclear fusion. (Author)

I400.0700 Manowitz, Bernard. *The Role of Fuel Reprocessing in the Economics of Atomic Power.* AEC NO. BNL-5479, Upton, N.Y., Brookhaven National Lab., May 1961.

Different types of fuel reprocessing plants are described, and the costs of operating three plants at three different scales are estimated. The factors which limit the throughput of the plants are considered and analyzed for four different types of fuel. Estimates are given for the cost of reprocessing these fuels in the various types of plants considered. (M.C.G.)

I400.0720 McDonald, G. "Nuclear Electrical Power for Canal Construction," *Mechanical Engineering,* Vol. 88, No. 8 (August 1966), 22-28.

I400.0740 McLeod, N.B., Reed, G.L. and Schwoerg, F. "Economic Potential of Direct Nuclear Superheat," *American Nuclear Society Transactions,* Vol. 8 (November 1965), 576.

I400.0760 Nuclear Utility Services, Inc. *Comparative Evaluation of Single and Dual Water-Cooled Reactor Power Plants.* AEC No. NYO-3289-1. Washington, D.C., Nuclear Utility Services, Inc., January 31, 1965.

An analysis is carried out to estimate the cost differences between single and dual reactor installations, and to identify advantages and disadvantages of dual installations that are not amenable to precise cost evaluation. The studied range of outputs for the total installation is 150 to 1000 Mwe. Three types of reactors are considered in the study: pressurized water reactor with chemical shim control; PWR with spectral-shift control; and boiling water reactor. It is concluded that the costs are about equal for the two types of installations. (T.F.H.)

I400.0800 Perona, J.J., Bradshaw, R.L., Roberts, J.T. and Blomeke, J.O. *Economic Evaluation on Tank Storage and Pot Calcination of Power Reactor Fuel Reprocessing Wastes.* AEC No. TID-17207. Tenn., Cak Ridge National Lab., October 1962.

To be published in IAEA (International Atomic Energy Agency) Proceedings of the Symposium on the Treatment and Storage of High-Level Radioactive Wastes, held in Vienna, Oct. 8-13, 1962. Costs were estimated for interim storage of wastes in tanks and conversion to solids by pot calcination. A 6-ton/day capacity fuel processing plant was assumed, processing 1500 tons/year of uranium fuel of 10,000 MWD/ton burn-up which would process all the fuel from a 15,000 MWe nuclear economy. Cost for storage of acidic and neutralized Purex and Thorex wastes were estimated for storage in stainless steel tanks for acidic wastes and mild steel for neutralized wastes. With interim storage time defined as filling time plus full time, tank costs were minimum when the full time was roughly 40 to 75% of the interim storage time. For 0.5-30-yr. storage, costs ranged from 2.0×10^{3} mill/Kwhe for alkaline wastes. Costs were estimated for converting acidic and reacidified Purex and Thorex wastes to solids by pot calcination and for producing glass from acidic Thorex wastes. The vessels studied, were made of 6-, 12-, and 24 in. dia. stainless steel pipe, 10 ft. high with estimated costs of $500, $855 and $2515. Aging had negligible effect on costs for processing in a vessel of a given size, because capital costs were only about 10% of vessel and operating costs, but permitted larger vessels to be used; costs for processing in 6-in dia. vessels. The lowest cost was 0.87×10^{2} mill/Kwhe for processing acidic Purex and Thorex wastes in 14-in. dia. vessels, and the highest was 5.0×10^{2} mill/Kwhe for processing reacidified Purex and Thorex wastes in 6-in. dia. vessels. (Author)

I400.0840 Pratt, M.H. *Comparative Economics of Large Fossil Fueled vs. Nuclear Generating Stations.* AEC No. AONF-650429-6. Syracuse, N.Y., Niagara Mohawk Power Corp., n.d.

From American Power Conference, Chicago. The comparative economics of large fossil-fueled versus nuclear power stations are discussed. Meeting construction schedules is considered. Economic studies on the Niagara Mohawk nuclear plant are described. (M.C.G.)

I400.0860 "Commercial Aspects of Fuel Processing," *Reactor Fuel Processing,* Vol. 7, No. 2 (1964), 88-104.

I400.0880 Rosenthal, M.W., Baumann, H.F., Bennett, L.L., Carlsmith, R.S. and Vondy, D.R. *Technical and Economic Characteristics of Thorium Reactors.* AEC No. STI-DOC-10/52. Tenn., Oak Ridge National Lab, n.d.

An investigation was made to estimate the performance and power costs that will be achieved with various proposed thorium reactors if they are built in the 1970's. The design information was taken from conceptual designs of 1000 MW(e) reactors provided by developers of the concepts. A set of economic factors that represent the average conditions over the life of reactors built during that period was defined and physics performance, capital, operating, and fuel cycle costs for all of the reactors were estimated on a consistent basis. For comparison with the Th reactors, similar estimates were made for a 1000 Mw(e) light-water moderator, pressurized water reactor. (M.O.W.)

I400.0900 Sargent and Lundy, Chicago. *Capital Cost Evaluation (Of) 1000 Mw(e) Molten Salt Converter Reactor Power Plants.* AEC No. SL-1954. Tenn., Oak Ridge National Lab., June 29, 1962.

The results are presented of a conceptual design and capital cost estimate of three variations of the molten salt-cooled power reactor cycle, each of sufficient capacity to develop approximately 1000 MW(e). A mixture of fluorides of lithium, beryllium, uranium, and thorium serves as the transport medium for the reactor fuel in each case, and the three concepts include a binary vapor cycle using mercury and steam turbines, an indirect power removal cycle that uses a nonfuel-bearing salt mixture as an intermediate coolant, and a direct power removal cycle in which the fuel salt transfers its heat to boiling water and steam in a system of heat exchangers. The cost estimates include all primary and intermediate coolant heat exchangers, the major steam cycle components, turbine plant auxiliaries, and the buildings required to house the reactor and turbine plant and the turbine auxiliaries. The power plants and associated auxiliaries are described. A description of the primary and intermediate heat transfer systems, which was prepared by ORNL as the basis of plant designs and estimates, is presented. (R.E.U.)

I400.0920 Taylor, E.O. "Nuclear Power Economics," *Technologist,* Vol. 1, No. 4 (1964), 30-37.

I400.0940 Vassell, G.S. and Tibberts, N. "System Planner's View of the Economic Significance of Planned and Forced Outages of Generating Capacity," *Transactions of the American Nuclear Society,* Vol. 9 (June 1966), 217-18.

I400.0960 Westinghouse Electric Corporation. *1000 Mw(e) Closed Cycle Water Reactor Study.* AEC No. WCAP-2385 (Vol. 1). Pittsburgh, Pa., Atomic Power Division, March 1963.

I400.1000 Young, Gale. "The Fueling of Nuclear Power Complexes," *Nuclear News,* Vol. 7, No. 11 (November 1964), 23-30.

DESALINATION

I500.0100 Atomic Industrial Forum. *Nuclear Applications to Saline Water Conversion. Economic Implications.* New York, 1964.

The results of studies on the economics of nuclear desalination plants, particularly plants also producing electricity, are summarized, together with associated technological efforts. Cost estimates are given, including comparisons of conventional and nuclear systems. (D.C.W.)

I500.0120 Baer, R.L. and Solberg, D.E. *Economics of Small Nuclear Electric Desalination Plants.* Hittman Associates, Inc., Baltimore, Md., n.d.

The economics of small (10 to 15 Mw (t)) nuclear plants which produce electricity and desalinate water were studied for the purpose of quantitatively determining the cost of electricity and water produced by small dual-purpose nuclear plants and to compare these to actual water and electricity prices for representative locations. It is concluded that there are many places where such plants are economically attractive compared to existing electric and water production units. These small dual-purpose plants are also as attractive as pilot plants because of their modest capital costs. (J.F.P.)

I500.0140 Barnhill, Kenneth G. "Estimated Cost of Desalting Three Florida Brackish Waters," *Journal of the American Water Works Association,* Vol. 54, No. 5 (May 1962), 526-528.

The estimated costs of desalting three Florida brackish waters by electrodialysis are presented. The author points out that desalination costs relate directly to water type.

I500.0160 Baron, S. "Economics of Desalination," *Spectrum,* Vol. 3, No. 12 (Dec. 1966), 63-70.

In an analysis of the thermodynamics of dual-purpose desalination plants, it is apparent that the base-loaded plant with noncondensing turbine provides the most economic approach to desalination even though new storage capacities will be required. Conveyance of water to existing reservoirs and variable operation of the water facility offer no economic advantages. Desalination of water is too expensive for agricultural applications, but it provides a promising source of fresh water for certain areas with special water problems where conventional supplies are inadequate to meet the needs of growing populations and increased industrialization. Thermodynamic comparisons of single-purpose power plants (fossil and nuclear); single-purpose water plants (fossil or nuclear); noncondensing dual-purpose (fossil and nuclear); and condensing dual-purpose (nuclear) plants are given. (F.S.)

I500.0180 Blanoo, R.E., Holmes, J.M., Salmon, Royes, and Ullmann, J.W. *An Economic Study of Ammonia Using Electricity from a Nuclear Desalination Reactor Complex.* AEC No. ORNL-3882. Tenn., Oak Ridge National Lab., June 1966.

One example of the use of large blocks of low-cost nuclear power predicted for the foreseeable future would be production of hydrogen and ammonia fertilizer by the electrolysis of water. The cost of ammonia production at a nuclear desalination site via electrolysis was compared with the cost using the conventional steam-methane reforming process. Factors studied included power cost, natural gas cost, production rate, return on investment, type of electrolytic cell, by-product oxygen credit, and transportation cost. Using electrolytic cells that operate at very high current densities, ammonia can be produced for $39/ton with power at 2.5 to 3.0 mills/kwhr. Such power costs are obtainable on an incremental basis from commercial light-water reactors. Large advanced reactors producing power at 1.6 mills/kwhr appear to be capable of producing ammonia competitive in the United States (assuming a credit for by-product oxygen) with steam-methane reforming using natural gas at 29 to 33¢ million Btu's. The average U.S. industrial natural gas price in 1963 was 34¢ per million Btu's. The production of hydrogen and ammonia fertilizer at a nuclear desalination site is considered sufficiently attractive to justify further study. (Author)

I500.0200 Burwell, C.C. *Economic Aspects of Nuclear Desalination.* AEC No. ORNL-P-1278, Tenn., Oak Ridge National Lab., May 3, 1965.

It may be stated that distilled water may be economically produced by distillation in a large dual-purpose nuclear facility. Projected water costs will be low enough for agricultural purposes if full advantage is taken of the favorable cost features of by-product electricity, natural uranium or breeder fuels, a large fuel-processing industry, and large-size construction. Further reductions in water cost will undoubtedly occur as the results of research and development are applied to the nuclear desalination industry. (Author)

I500.0220 Burwell, C.C. and Hammond, R.P. *Cost Allocation Procedure for Dual-Purpose Power-Desalting Plants.* AEC No. ORNL-TM-1615. Tenn., Oak Ridge National Lab., November 1966.

A procedure for the allocation of the total cost of a power-desalting plant to the separate products is described. The cost of producing the energy required by both products includes the cost of rejecting waste heat. The production cost of energy in the form of prime steam is divided between the cost of power and water according to its potential for producing electric power. Common facilities not associated with the production of energy are allocated to water and power costs according to the use or benefit that each product receives. The method has the characteristic that for an energy source with a given capacity the water-to-power production ratio may be varied over a range of values without significantly changing the cost of either product as long as the temperature of the heat supplied to the water plant is within the useful range for the process being used. The characteristic is due to the fact that: (1) since the energy cost component of power cost is constant for a given energy source, the unit power cost varies in the relatively minor effect of the equipment and operating unit costs of the power station as a function of size; (2) the variation in exhaust steam cost to the water plant as a function of exhaust pressure is balanced by a variation in the water plant design (if optimum) to match the water plant efficiency with the cost and conditions of its heat source. (Author)

I500.0240 Catalytic Construction Co. and Nuclear Utility Services, Inc. *A Study of Desalting Plants (15 to 150 mgd) and Nuclear Power Plants (200 to 1500 Mw(t)) for Combined Water and Power Production.* AEC No. NYO-3316-1. Washington, D.C., Catalytic Construction Co. and Philadelphia Nuclear Utility Services, Inc., September 1964.

An analysis is carried out of the various factors affecting the economics of sea-water desalination by a multi-stage flash-evaporation plant, operated in conjunction with an electricity-generating station. Four concepts are considered as power sources for the combined facility, namely low- and high-temperature nuclear reactors and low- and high-temperature natural-gas boilers. Plant sizes of 200 to 1500 Mw(t) are considered. The Economics of the station are compared with the economics of separately operated plants of the same water and electric outputs. (T.F.H.)

I500.0460 Lamb, James C., III. "Economic Aspects of Saline-Water Conversion," *Journal of the American Water Works Association,* Vol. 54, No. 7 (July 1962), 781-788.

The economics of desalination are reviewed leading to nine conclusions relating to the status of saline-water conversion. Chief among these are that desalination will not significantly supplement the national water supply in the foreseeable future, but that it may be an important solution to water supply problems in local situations.

I500.0480 Pardee, F.S. Economic Planning and the Military Electronic Industry. P-2006. The RAND Corp., Santa Monica, Calif., June 1960. (DDC No. AD 419-745).

Economic analysis in defense activities is described as an application of both macro-economics and micro-economics. Macro-economics applies to aggregates such as GNP, R & D expenditures, the military budget, etc., while micro-economics examines, by cost sensitivity analysis, the economic aspects of military systems, such as alternative hardware designs, operating methods, and other features of individual systems. The elements of an electronic system and their sensitivity to costs are examined through cost-sensitivity analysis. Economic trade-off conditions, such as the cost of increased miniaturization versus increased payload capacity, are considered. Cost-sensitivity analysis is described as a method of estimating the economic pact of alternative engineering designs, concepts of maintenance, logistics, training, and other operational deployment considerations.

I500.0600 Reed, S.A. and Moyers, J.C. *Estimation of Annual Operating and Maintenance Operating Costs of Dual-Purpose Nuclear-Electric Sea Water Conversion Stations.* AEC No. ORNL-TM-1057. Tenn., Oak Ridge National Lab., April 1965.

Estimates of the operating and maintenance costs of dual-output nuclear desalination plants are presented, based on projected manpower requirements, supplies, and maintenance materials for base-load stations having 90% plant factor. Two multi-stage flash evaporator plants have been considered; a 165 x 10^6 gpd plant coupled to a 3220 Mw (t) nuclear-electric plant powered by a pressurized water reactor, and a 10^9 gpd evaporator plant operated with a 25,000 Mw(t) nuclear-electric plant which was powered by three pressure tube reactors. (Author)

I500.0620 Reed, S.A. and Moyers, J.C. *Estimation of Interim Replacement Costs of Dual Purpose Nuclear-Electric Sea Water Conversion Station.* AEC No. ORNL-TM-994. Tenn., Oak Ridge National Lab., December 1964.

Expected useful lifetimes have been obtained or estimated for typical components of dual-purpose nuclear-electric, sea water conversion stations. The component lifetimes were used to prepare tables of sinking fund factors, based on procedures published by the Bureau of Reclamation, for computing the costs of interim replacement of

equipment for stations having lifetime expectancies of 30 and 50 years. Employing these sinking fund factors for 4% interest rate, annual interim replacement costs were calculated for a nuclear-electric plant using a 320 Mw(t) pressurized water reactor, for a 25,000 Mw(t) nuclear plant comprised of three pressure tube reactors, and for two multistage-flash evaporator sea water conversion plants which had rated outputs of 165 and 1000 MGD respectively. At 4% interest rate, the annual replacement costs for 30-year-life plants, expressed as percent of initial investment, were estimated to be 0.27 and 0.42% for the 3220 and 25,000 Mw(t) nuclear-electric plants, respectively, and 0.33 and 0.38% for the 165 and 1000 MGD sea water conversion plants, respectively, exclusive of heat exchange surface. For 50-year-life stations, the annual replacement costs were 0.51% for the 3220 Mw(t) plant, 0.81% for the 25,000 Mw(t) plant, and 0.41 and 0.46% respectively for the 165 and 1000 MGD evaporator plants, exclusive of heat exchange surface. The annual replacement cost for the entire evaporator plant, including heat exchange surface, is strongly influenced by the choice of tube and tubesheet material. The annual replacement deposits for the 165 and 1000 MGD conversion plants with copper-base alloys were 2.1 or 2.6% of the initial investment, respectively, for 30-year-life plants, and 2.2 or 2.6%, respectively, for 50-year-life plants. The annual deposit for the 1000 MGD plants would be 0.14 and 0.17% for the 30- and 50-year-life plants, respectively, if titanium were used. (Author)

I500.0700 Skinner, Robert A. "Sea Water Conversion Study in Southern California," *Journal of the American Water Works Association,* Vol. 57, No. 6 (June 1965), 694-698.

This article discusses the development of a joint study between the Metropolitan Water District of Southern California, the United States Department of the Interior, and the Atomic Energy Commission. The study was to determine the engineering and economic feasibility of, and to develop a preliminary design for, a combination desalting and power plant of 50-150 million gallons per day, and 150-750 megawatts of electric power production. The advantages of desalination, and the uses of distilled water are also discussed.

I500.1000 Atomic Energy Commission. *Large Reactor Study for Sea Water Distillation.* AEC No. TID-19267. Calif., Bechtel Corp., July 1963.

The results of a study of large nuclear reactor systems for supplying energy for the distillation of sea water are presented. The reactor types and sizes studied include: one 1500-Mw(t) light-water reactor of current technology; three 1500-Mw(t) light-water reactors in a single plant; one 3220-Mw(t) light-water reactor; one 3500-Mw(t) heavy-water-moderated, organic-cooled reactor; one 3500-Mw(t) graphite-moderated, light-water-cooled reactor; one 8300 Mw(t) heavy-water-moderated, organic-cooled reactor; a multi-unit 25000-Mw(t) station with high conversion ratio reactors; a 25000-Mw(t) station using an unspecified number of slightly enriched reactors; and an unspecified number of fast breeder reactors of 25000-Mw(t) total capacity. A summary of technical design data is presented. Costs for all cases were calculated and translated into annual costs. (M.C.G.)

I500.1100 Task Group on Nuclear Power and Saline Water Conversion. *Appendices to an Assessment of Large Nuclear Powered Sea Water Distillation Plants.* Washington, D.C., U.S. Government Printing Office, March 1964.

Technical design and performance data are given for dual-purpose power plants for 1500 to 25,000 Mw(t) using boiling reactors, pressurized reactors, heavy-water reactors, organic-cooled reactors, liquid metal-cooled reactors, high-conversion reactors, enriched-fuel reactors, and fast breeder reactors. Power value estimates for the dual-purpose desalination plants are presented. Methods of desalination are discussed. Evaluation of potential water markets in southern California coastal areas is considered. Federal Reclamation financial criteria are applied in assessing the large distillation plants. "Assessment of Large Nuclear Powered Sea Water Distillation Plants" was included in NSA 18: 19403. (R.E.U.)

AGRICULTURE

I600.0100 Daniel Yankelovich, Inc. *Cost-Benefit Analysis of Selected Radiation Pasteurized Meats.* NYO-3666-1. Study in Progress for the United States Atomic Energy Commission. New York, December 1966.

A cost-benefit study of six selected products in the AEC low-dose food irradiation program was made. The six selected products were finfish (cod, haddock, sole, and flounder); West Coast Dungeness crab; Alaskan king crab; bananas; Hawaiian papayas; and tropical mangoes. Key recommendations were made including the following: to continue the program for selected products, such as finfish and papayas, as commercialization can be achieved; commercialization objectives should be narrowly defined and work on relatively few products should be continued; selected products should be those for which a well defined market exists; funding should be at a lower rate and fewer products included; and a government sponsored information program should be provided. (F.S.)

I600.0200 Daniel Yankelovich, Inc. *Cost-Benefit Study of Selected Products in Atomic Energy Commission's Low-Dose Food Irradiation Program.* (AEC Report NYO-3666-1). New York, December 1966.

This cost-benefit study was done to determine the commercial feasibility of the marketing of selected irradiated foods. Six products were investigated for comparative costs of competitive food preservation techniques, consumer attitudes, and producer attitudes.

I600.0300 Southern Interstate Nuclear Board. *Applicability of Radiation Pasteurization in the Southern Region: Oranges, Grapefruit, Tomatoes, Peaches, Strawberries.* TID-21710. Atlanta, Ga., Southern Interstate Nuclear Board, September 15, 1964.

This investigation dealt primarily with the effects of radiation pasteurization on spoilage incurred in the marketing system for grapefruit, oranges, peaches, strawberries and tomatoes. The results show that the value of grapefruit, oranges, and peaches saved was not sufficient to cover the cost of irradiation. The value of strawberries and tomatoes saved was more than the cost of irradiation. Although radiation pasteurization of grapefruit, oranges, and peaches did not appear to be feasible, this analysis was based on an average spoilage rate for the U.S. rather than on spoilage rates for specific areas. *Further consideration should be given to the spoilage rates for specific producing areas. This is especially true for grapefruit and oranges because if irradiation could save as much as three percent of the fruit shipped, the benefits would exceed the cost.* This analysis was based on a savings of slightly more than one percent for these two fruits.

This analysis did not consider changes in the quality of the product that reaches the final consumer. A conclusive analysis must include market shipments and quality testing

after the product has been moved through the normal channels of trade. The price consumers are willing to pay for irradiated fruit may be either higher or lower than for nonirradiated fruit. If they are willing to pay a higher price for irradiated fruit, this increase in the value of the product may be sufficient to more than cover the cost of irradiation. This phase of work was also restricted to the domestic market and even if irradiation is not feasible for this market, it may be feasible to irradiate a portion of these fruits for foreign shipment. Since considerable time lags are required for foreign shipment, extension of shelf-life for these fruits would be of major importance. After the extent to which shelflife can be extended has been established, the relevant foreign markets should be delineated and then an economic evaluation made.

An analysis of selected producing areas should be undertaken to determine other commodities that may utilize the irradiation facilities when these fruits are not available. It may be possible to spread the overhead or fixed cost of such facilities over more products and thus reduce the unit cost of irradiating individual items.

The gross benefits from reduction of spoilage by irradiation estimated in this study are of such a magnitude that additional investigation of the feasibility of establishing radiation pasteurization facilities should be conducted. Apparently there are some social benefits that can be realized. However, final determination of feasibility must be cast in specific terms applicable to the particular geographic area in which the facility is to be located. (Author)

I600.0400 U.S. Department of Agriculture, Economic Research Service. *Economic Feasibility of Radiation-Pasteurizing: Fresh Strawberries, Peaches, Tomatoes, Grapes, Oranges, and Grapefruit.* TID-17886. Washington, D.C., August 1963.

Ionizing radiation pasteurization is a method that might be used to extend the cold storage life of fresh strawberries, peaches, tomatoes, grapes, oranges, and grapefruit. In a survey conducted for the Atomic Energy Commission during the summer of 1962, fresh produce handlers were asked to state their opinions and judgments about the merits of the method. Prior to interviewing, respondents were sent information and then were briefed about radiation processing so that answers to survey questions might be more meaningful and useful. Briefing was necessary because the new process has been used only in research and is not available commercially. Among the advantages expected of radiation pasteurization, the two most often given by respondents are that it would (1) reduce spoilage losses, and (2) maintain quality. Among the disadvantages expected, the one most often given, is consumer resistance due to fear of the process. Two other disadvantages often given are that it would (1) require an extensive educational program, and (2) increase processing costs. A high percentage of respondents thought successful market introduction of radiation-pasteurized fruits and vegetables would depend on an effective educational or promotional program. The purpose of the program would be (1) to acquaint consumers with the new process, (2) to inform them of its potential value, and (3) to assure them that radiation-pasteurized fruits and vegetables are completely safe for human consumption.

A majority of the respondents thought that radiation processing would increase the production and market volume of the selected fresh fruits and vegetables surveyed, but would not change output and sales volume of canned, frozen, and other processed forms. A minority of the respondents thought the new process would reduce output and sales volume of canned, frozen, and other processed forms of the selected commodities. A packinghouse or shipping point was selected as the most appropriate location for radiation processing, and except for strawberries, a small stationary radiation facility for each handler was thought to be the best for processing the selected commodities. For strawberries, a large centrally located facility and a mobile facility were each reported by one-third of the respondents as the most appropriate facility. Only one-sixth of the respondents handling strawberries thought a small stationary facility was needed.

Most respondents thought only minor changes in present methods of handling produce would be required to accomodate radiation processing. However, about half of the few who preferred a large, centrally located facility thought substantial changes in present handling methods would be required. (Author)

I600.0600 U.S. Department of Agriculture, Economic Research Service. *Radiation-Pasteurizing Fresh Strawberries and other Fresh Fruits and Vegetables: Estimates of Costs and Benefits.* ERS-225. Washington, D.C., March 1965.

Radiation-pasteurizing of strawberries would reduce spoilage loss by at least enough to pay the cost of treatment, according to preliminary estimates of costs. Additional savings might be realized because (1) the shelf life would be increased, (2) less in-store culling would be necessary, and (3) use of carbon dioxide gas as a mold inhibitor could be reduced or eliminated. For California strawberries shipped to New York City, the present cost of the carbon dioxide treatment is about 0.3 cent per pound.

Considerable potential exists for reduction of spoilage loss of fresh peaches, tomatoes, oranges, and grapefruit, but more technical research information is required before estimates of economic feasibility of radiation-pasteurization can be made. The U.S. retail value of recent spoilage losses of these commodities is 0.2 cent to 4.9 cents per pound of shipping weight. Tomatoes are to the top of this range.

Technical research at the University of California, Davis, reveals that if fresh strawberries are radiation-pasteurized by an optimum dose of 200 kilorads it is possible to hold spoilage losses during marketing to about 5 percent, depending on amount of infection with spoilage organisms at harvest. Accordingly, estimates of spoilage loss savings, on the basis of the recent U.S. retail price of 45.2 cents per pound, would range from 4.3 to 4.5 cents per pound shipped to market, depending on the extent to which the practice was adopted by the strawberry industry. Savings in this range are substantially more than enough to pay for estimated radiation pasteurizing costs.

The adoption of radiation-pasteurization by the strawberry industry would represent a significant increase in the barriers to entry of new shipping firms because of the investment requirements. Consequently, one would expect shippers to increase in size and decrease in number, perhaps accompanied by some increase in market power of the surviving firms.

Fruit and vegetable handling and marketing methods would not be expected to change significantly as a result of radiation-pasteurization. However, because of increased shelf life more time would be available for orderly marketing. This is especially important for highly perishable produce commodities. (Author)

SPACE

I700.0100 Brooks, J.E. *Cost Effectiveness Formulation for Standardized Space Guidance System Study.* TRW Space Technology Laboratories, Los Angeles, California, April 1964.

I700.0120 Campbell, H.G., Dreyfuss, D.J., Margolis, M.A. and String, J. *Sensitivity Examination of Alternative Manned Space Plans.* RM-5088-NASA. The RAND Corporation, Santa Monica, California, August 1966.

Describes a study of a series of NASA plans. A comparison of the respective resource requirements was made to evaluate the financial impact of variations in key planning and design characteristics. Funding requirement comparisons of alternate planetary, earth orbital, and lunar programs were made.

I700.0140 Dolan, T.E., Long, W.C. and Lundberg, R.H. "Costing Methodology and Program Costs for a Manned Lunar Landing and Return Mission – Project Mallar," *Advances in Astronautical Sciences --Proceedings of the Meetings of the American Astronautical Society,* Vol. 8. New York, Plenum Press, 1963, 332-352.

A cost analysis methodology is described as it applies to the conceptual and preproposal phase of advanced systems design. It is characterized by basic cost data preparation, application to system concepts, refinement of system design and summary costs, breakdown of summary cost information and refinement with specific cost inputs, introduction of contingency factors, and final program cost analysis and summary. The method is applied to the lunar mission as an example.

I700.0160 Gale, Harold W. *A Quick Method for Evaluating Rocket Performance Trade-offs of Unequal Cost-effectiveness.* TDR-65-1. Rocketdyne, Canoga Park, California. January 1965. (DDC No. AD 462-167).

This report presents a quick way to estimate cost effectiveness of rocket propulsion performance improvements. Payload, velocity, orbit, range, weight, specific impulse, and cost are considered. Cost charts are presented in form only. From performance trade-offs it was concluded most boosters operate in the region of maximum performance sensitivity to specific impulse. Large gains in specific impulse tend to be most expensive in the same region. Attitude controls and high velocity upper stages share strong sensitivity to small changes in propellant load. Conventional specifications for attitude controls were misleading for best delivered performance, and possibly for cost. A method of hand computation based on charts was devised. (Author)

I700.0180 Grodsky, M.A., Levy, G.W. and Sorkin, R.D. *A Model of Human Maintenance Behavior-I: Development of the Problem and Evidence for a Model.* Report 11133. The Martin Company, Orlando, Florida, 1960.

Four criteria are suggested for studying the advantages of automatic or manned modes for space flight: payload weight, economy (overall operational costs), utility of man, and mission effectiveness.

Previous studies indicated that application of these criteria justified a manned vehicle. 'It is apparent that there is a definite per cent weight advantage in using a manned mode of maintenance as opposed to an automatic mode of maintenance. It should be noted that the increased weight in the manned mode of maintenance also includes the weight required to support men within the system.' These savings may be attenuated in the actual case because equivalent or greater cost expenditures would be necessitated by the selection and training of personnel to perform maintenance.

I700.0200 Hatry, H.P. *Economic Analysis in the Selection of Space Systems.* (TEMPO), SP-130. General Electric, Santa Barbara, California, Technical Military Planning Operation, April 1961.

The need for economic analysis in system selection is described as being based on the objective of making the best use of available resources. Economic analysis should be continuing and sequential paralleling the development of a system from its conception, through the design and production of specific hardware, to its maintenance and operation. The performance evaluation and the cost analysis should be undertaken jointly. The use of cost analysis to weigh the alternative characteristics or specifications of a system is described. Uncertainty in the analysis of future systems is discussed.

I700.0220 Hill, Fosdick Emerson. *Operational Determinations for Strategic Interplanetary Fleets.* Air Force Missile Test Center, Patrick AFB, Florida, SCPO, September 1960. (DDC No. AD 239-363).

I700.0240 Margolis, M.A. *Economic Aspects of Developing and Orbiting a Space Station.* P-1975. The RAND Corp., Santa Monica, California, April 1960. (DDC No. AD 224-321). Also published in *Aerospace Engineering,* Vol. 19, No. 5 (May 1960), 84-85.

Economic aspects become important when several means of carrying out a proposed space mission are under consideration. The possibility of funding the program in the light of existing military space commitments and the ability of the economy to support higher budgets are also economic problems. This paper is concerned, primarily, with the economic considerations of a space transfer station. The space transfer station is compared with the employment of large boosters for space missions. The costs of alternative methods of conducting space missions are discussed, as well as the economic impact of space expenditures on the national economy.

I700.0260 Margolis, M.A. and Pardee, F.S. *Economic Considerations of Space Flight Ground Support Requirements.* P-1589. The RAND Corporation, Santa Monica, California, January 1959. (DDC No. AD 224-138).

This paper describes the need to develop a complete systems cost for advanced systems, including all costs for research and development, initial investment, and the operation of the system. A format, with a list of cost elements, illustrates a method for ensuring complete compilation of program costs. Also considered is the cost implication of the use of inherited resources. The growing importance of ground support is described. An outline of space flight facilities is provided to assist in the economic evaluation of procurement and construction of such facilities. The problem of determining the need for increasing the number of operating space facilities is discussed, along with the relevant considerations for such decisions.

I700.0280 Margolis, M.A. and Barro, S.M. *Program Budgeting for Space Activities.* P-4960-RC. The RAND Corp., Santa Monica, Calif., August 1965.

A discussion of the application of program budgeting concepts to the national space program. The Memorandum reviews current and future activities of the federal agencies that participate in the space program, identifies certain program characteristics that will facilitate the introduction of program budgeting, and discusses other characteristics that may present difficulties. The nature of space program objectives and their relationship to missions and budget categories are examined in detail. Specific suggestions are made on how to convert from the existing budget to a program budget format, and some of the analytical applications of a space program are mentioned.

I700.0300 Margolis, Milton A. and Barro, Stephen M., "The Space Program," *Program Budgeting,*

Program Analysis and the Federal Budget, ed. David Novick. Cambridge, Harvard University Press, 1965. p. 120-145.

The applicability of the space program budgeting is discussed. The present system orientation and a long planning horizon of the space program facilitate the budgetary changeover.

I700.0320 Noah, J.W. *Identifying and Estimating R & D Costs.* RM-3067-PR. The RAND Corporation, Santa Monica, California, May 1962. (DDC No. AD 283-794). Also published as Chapter VII, "Estimating Research and Development Costs of Large Launch Vehicles," in J.P. Large (ed.), *Concepts and Procedures of Cost Analysis.* RM-3589-PR. The RAND Corporation, June 1963, (For Official Use Only), pp. VII-1–VII-54, (DDC No. AD 411-554).

Consists of instructional material for estimating research and development costs, particularly for ballistic missile or launch vehicle systems. With some modification, the techniques presented can also be applied to aircraft and spacecraft. A detailed list of R & D cost elements is provided as a basis for data compilation and the development of estimating relationships. Methods for developing estimating relationships for R & D cost elements, and estimating equations for cost elements are presented. The problems and methods of organizing R & D cost estimating tasks are discussed. Sample formats are shown for the system specifications needed for estimating purposes.

I700.0340 Novick, David. *A Discussion of Space Program Costs.* The RAND Corporation, Santa Monica, California, February 1964. (DDC No. AD 433-852).

I700.0360 String, J. *A Model for Projecting Costs of Space Exploration.* P-3119. The RAND Corp., Santa Monica, California, April 1965. (DDC No. AD 615-517).

Describes a model for estimating the costs of advanced space hardware and for assessing the budgetary implications of integrated space exploration plans. The model is described as a long-range planning model for evaluating alternative overall space plans and their funding requirements.

I700.0380 String, J., Jr. *A Model for Resource Analysis of Space Programs.* RM-5347-NASA. The RAND Corporation, Santa Monica, California, March 1967.

I700.0400 String, J. *Procedures for Estimating the Resource Requirements of Manned Space Flights.* P-3382. The RAND Corporation, Santa Monica, California, June 1966.

Discusses a model developed to estimate the cost of NASA programs. Illustrative computer outputs are included for a typical manned space flight plan. The procedures embodied in the model are discussed. The resource implications are presented of the major types of activities under consideration for the NASA advanced manned space program. The derivation of the cost-estimating relationships for production and development costs is explained.

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